PUBLIC WORKS

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City County State

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PUBLIC WORKS

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? ? ? Brainteasers ? ? ?

Mikey & Ikey Again:

J. F. Finley and the New York Sun want more information concerning this elusive pair. Mikey and Ikey have been drinking again and are befuddled. Ikey is Mikey's stepson. Mikey is now one and one-third times as old as he was when he took to drink. Ikey was born five years before Mikey started to drink, and Ikey is now two years older than half as old as Mrs. Mikey was when Mikey took to drink. When Ikey reaches the age that Mikey was when Mikey started to drink, the ages of Mikey and Ikey and Mrs. Mikey will total 150 years. How old are they now?

Bridge Calculations:

There are deck bridges and bridge decks. This has to do with the latter. Twelve people, each having the disposition of a petulant *Opsiceros bicornis*, cannot bear to play as partners more than once in the course of an evening. How many arrangements are possible, so that, using three tables, no player is seated opposite, or on the right of, or on the left of any other player more than once?

Here and There:

Letters from far-off Australia, and visitors from little old New York testify to the interest in these nutcrackers. But Walter S. Wheeler, from rocky New Hampshire, earns whatever reward may attach to persistent early sending in of solutions, though others are occasionally close contestants. (This month, Messrs. Moyer and Brown.) Mr. Wheeler, in spite of a personal dislike for bootleggers' stuff, as he puts it (he recalls with pain the Alaska Gold Rush methods wherein the stigma of dilution was counteracted by the generous addition of Worcestershire Sauce), came in first last month.

Solutions and Dilutions:

The escalator problem showed just how much time can be saved by rushing for trains. The saving may not always be worth the effort, but solving the problem is—at least to us. From

$$S = (n - 26) \div 30 = (n - 34) \div 18$$

n, the number of steps in the stairway, is found to be 46 and s, the speed of their travel is ⅔ steps per second. It is not necessary to know the speed of walking to work the problem.

Five dollars per gallon was the unit price paid by the bootlegger. He added 30 gallons of water each time (without Worcestershire Sauce), getting as profit $320 and having $16 dollars' worth of original liquor in the final stock. It is hoped that correct solutions were obtained by methods other than algebraic equation. In this case, equations are as involved as the problem—or more so.

Yea, Verily:

Some of us, no doubt, are beset by problems more pressing and more serious than this column can offer. And really, there is no good reason for exchanging familiar for strange problems, nor for adding to an already full supply. Nevertheless, when you can spare a moment or two, try one of these. You will certainly find diversion, probably relief—and possibly the correct answer.

And who can suggest a better name than "? ? ? Brainteasers ? ? ?" The polls are now open. Who will cast the first bright idea?

BENJAMIN EISNER

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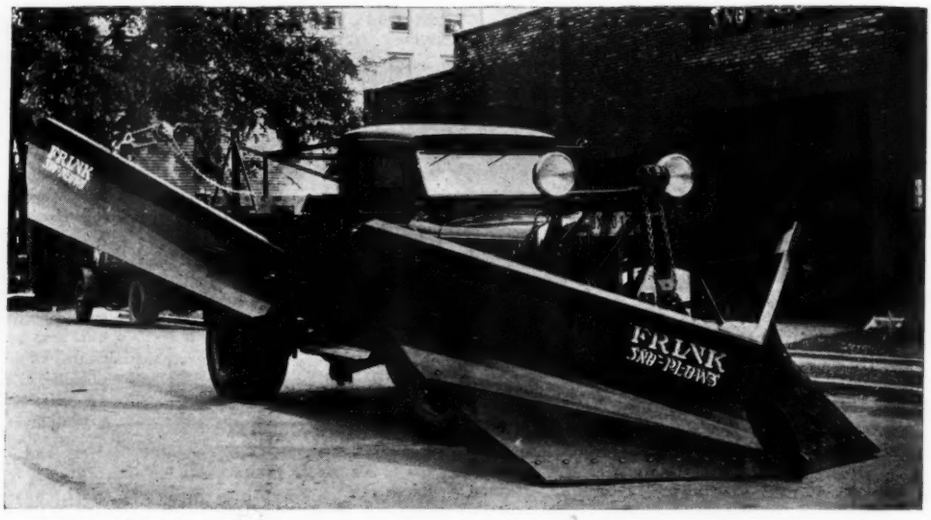

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 63 *October, 1932* No. 10

When Should Snow Removal Start?

Concise reports from highway engineers of several states show that the practices of some states of starting with the storm, and of other states of waiting until it ends, are based upon intelligent recognition of local conditions

TO START, or not to start snow removal is a question that often must be decided when snow is falling and wind blowing. There seems to be a most decided difference of opinion on this subject, especially in its relation to state work.

Some of the objections to starting work early are that, due to the snow and wind, cuts fill up again soon after being opened; the work under storm conditions is extremely hard on both men and equipment; and so much time must be spent in extricating motorists from drifts that working efficiency is greatly reduced, and there is also danger of accidents by collisions with stalled automobiles.

On the other hand, if the snow is allowed to drift deeply and consolidate, it is much more difficult to remove; it probably will be necessary to dig out a good many automobiles, anyway, and an early rescue may conceivably save lives or prevent dangerous exposure. Also, the roads are kept fairly open all the time, which may prevent the stalling of some cars.

Probably much depends upon the locality, and upon the type of storm, which in turn depends to some degree upon the locality. Where high winds prevail, an early start is questionable; in more southern sections where storms heavy enough to require removal work are not so common, and where the snowfall is not accompanied by high wind, an early start is undoubtedly desirable. We have asked a number of states their practice in this regard, and the information received from them is listed below:

North Dakota.—Snow storms in North Dakota are usually accompanied or followed by high winds, and snow removal equipment does not start to work until the wind goes down. T. G. Plomasen, Maintenance Engineer.

South Dakota.—Snow removal is started as soon as practicable after a storm. It is a mistake to start this work until after the storm has subsided, especially when accompanied by a high wind. Snow removal attempted at this time is not only a waste of money but it aggravates the condition by heightening the snow wall along the road and increasing the amount of snow that it will be necessary to remove after this storm and other storms that may follow. J. H. Lake, Highway Engineer.

Connecticut.—The work of snow removal is organized so that the superintendent of maintenance in each district is ready to strike the minute a snow storm starts. Generally we have the snow storms beaten before they begin, as snow plows are at work immediately the snow begins to accumulate. C. G. Nichols, Executive Secretary.

New Hampshire.—The plows start, usually at the beginning of the storm, or before the snow has drifted to any extent. We have found that the best results are to be obtained by the use of trucks with blade plows where the plowing can be done in advance of the drifting. If the work can be started during the early stages of the storm, no difficulty will be encountered. Many miles of snow fence eliminate the difficulties in many places where drifts were likely to occur. John W. Childs, Maintenance Engineer.

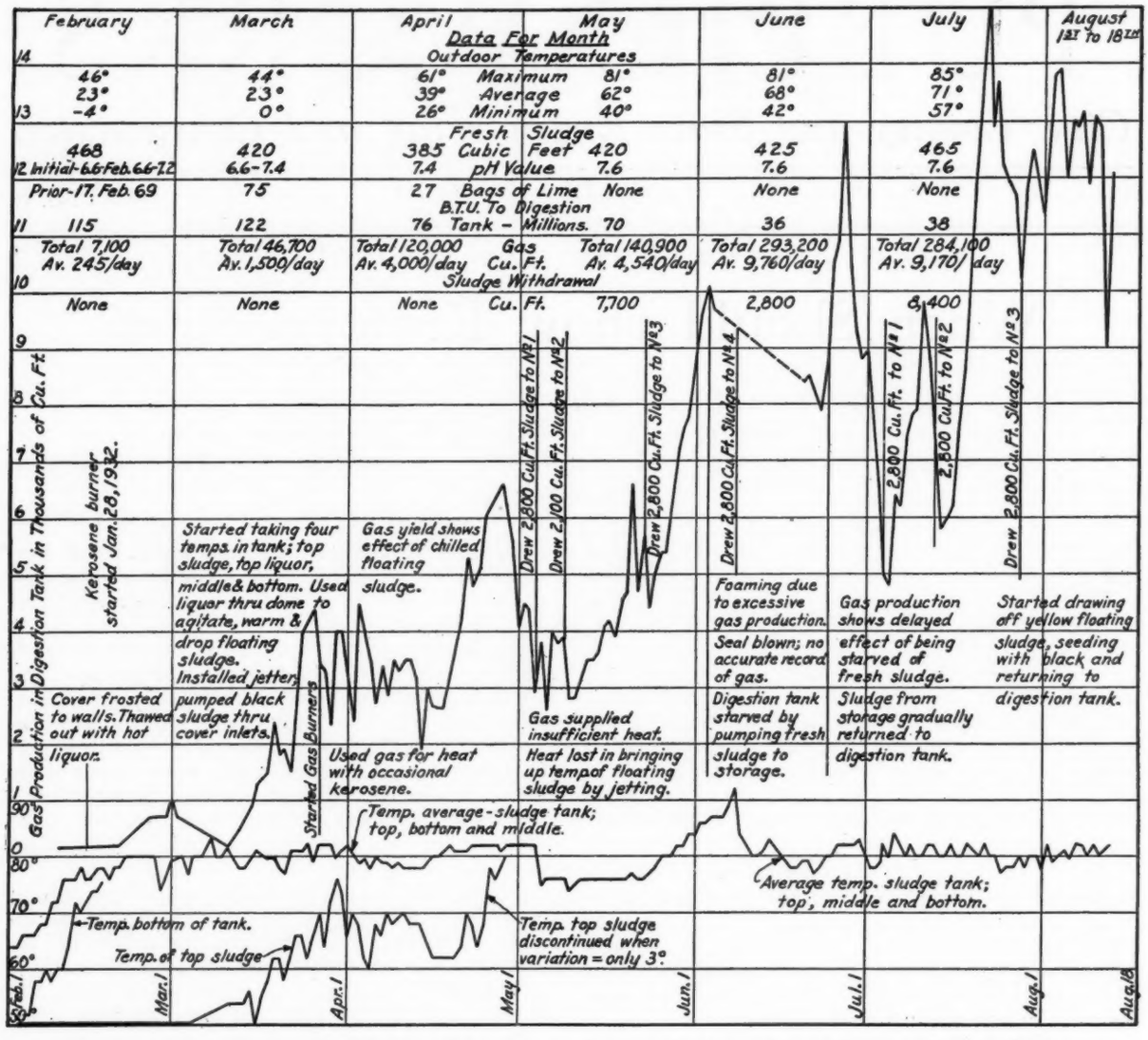
Pennsylvania.—Drivers and mechanics are subject to call upon notice from the Weather Bureau of approaching storms. As soon as the depth of snow reaches two inches, the plows start work and continue until the snow fall and drifting cease, after which outlets are opened for drainage and necessary widening done. P. W. Tebbs, Assistant Chief Engineer.

Massachusetts.—General instructions are to start work with the storm and continue until the storm has finished and the roads are clear. A. W. Dean, Chief Engineer.

Rhode Island.—When snow storms are impending, the gangs assemble at their respective headquarters throughout the state, and start out as soon as there is approximately two inches of snow on the ground. Our method is to start with the storm and keep going contiuously until the storm is over. G. H. Henderson, Chief Engineer.

Idaho.—In sections where there is very little drifting, plowing is continuous with the fall of snow and until it ceases to fall. In the drifting sections, plowing commences as soon as the blizzard is over. P. E. Oxley, Maintenance Engineer.

It would appear from these reports that, in the east, where there is presumably more traffic—and also more equipment per mile of road—the more general practice is to begin work as soon as the snow starts to fall, or very shortly thereafter; while in certain sections of the north and west, especially where many of the storms are accompanied by high winds, this practice is not generally followed. In fact, through the northwest-central states, it is generally considered most desirable not to start work until the storm has ceased and the wind dies down.



Digestion tank operation: Monthly data of operation, with curves showing tank temperatures and gas production

Sedimentation Experiments and Digestion Data at Saranac Lake

By Henry W. Taylor
Consulting Engineer, New York City

THE planning and construction of the sewage treatment plant for the village of Saranac Lake, N. Y., were described in the April issue of PUBLIC WORKS. As stated therein, it consists of three settling tanks equipped with parallel sludge collectors, a sludge digestion tank, sludge storage tank and sludge beds. The plant was put into operation December 9th, 1931, and has been treating sewage from a population of 10,000.

Before the plant was put into regular operation, one of the settling tanks was used for experiments and tests relating to the operation and characteristics of the sludge collectors and to the deposition of fresh sludge in a flat-bottom tank; which experiments were conducted by the writer for the Jeffrey Manufacturing Co. and through the courtesy of the company, a brief outline of them is given herewith.

Each tank is 75 ft. long, 16 ft. wide and has an average depth of 7 ft., giving a total detention period of 3.25 hours for 10,000 population. The flow through this unit was determined by means of a special weir serving it alone. A test was made, under actual working conditions, of the power used for operating the sludge collector; and experiments to determine the different amounts of sludge deposited in different sections of the tank length.

It was found that the main power consumption was due to static and frictional losses in gears and shaft

bearings, one test, made during cold weather, showing power consumption of 0.644 kw. before the clutches for the conveyor units had been thrown in and while the bearings were cold, but only 0.640 kw. when the conveyor of one unit was being operated, and 0.591 kw. when the conveyor was thrown out of operation again but after the bearings had been warmed up, indicating a power of about .05 kw. required to operate the conveyor. It seemed to make no perceptible difference in the power demand whether a unit were heavily loaded with sludge or practically cleared of it.

The collectors were operated in various ways to ascertain the length and frequency of operation required to keep the tanks properly cleared of sludge. A tank unit was left without sludge removal for 48 hours and the collectors then operated for one half revolution, and the tank was then dewatered and the bottom found to be clean. Also it was found that if the conveyor was operated for one half revolution twice a day the result was perfectly satisfactory. There seemed to be no practical gain in a continuous operation of the collector. Operating the collectors for two 40-minute periods, each giving one half revolution, consumed less than one kwh. per day. Continuous operation was not required to prevent ice formation which would interfere with the collectors, even during weather when the temperature fell to 4° below zero.

Study of Sludge Deposits

Various experiments were made to determine the amounts of fresh sludge deposited in different parts of one of the tanks operated under normal conditions but at various velocities of flow. The results of the several tests proved unexpectedly uniform when we consider the possibilities of wide variations in conducting such tests under operating conditions. The tests were made at various velocities of flow ranging from 0.09 inch to 0.376 inch per second, those between 0.09 and 0.13 being grouped together and termed "low velocity tests" and those above this being termed "high velocity tests." The accompanying diagram shows two curves, one for high and one for low velocities, plotted from the results of these tests. There was, of course, variation in the character of the sewage from day to day, and varying relative amounts of heavy, medium and light sludge in any one day's sewage.

Jars to receive the settling sludge were placed on the bottom of the tank at various points. The sludge collected in each jar was poured into an Imhoff cone and allowed to settle for 15 minutes and the amount which had settled was read and converted into depth of deposition for the catchment area of the jar. The depths at various points in the length of the tank were plotted and lines drawn between these points, and volumes and percentages of volumes of sludge deposition were computed from the area lying below the curve within the section of the tank in question.

Averaging all the experiments, it was found that 50% of the total sludge deposition took place in the first 25% of the length of the tank; 78% in the first 50% of the length, and 90% within 70% of the length. Over 30% took place in the first 10% of the length. It would seem, from these figures, that the conveyor could, if so desired, be placed so that from one-third to one-half of the sludge deposition would occur directly into sludge pockets and not have to be moved by the conveyor; and other interesting conclusions can be derived from this study.

Digestion and Gas Production

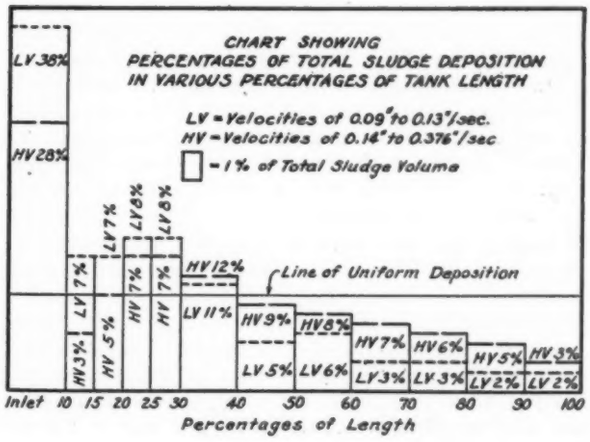
The sludge from the settling tanks is pumped to one of two sludge tanks; one of which, used as a digestion tank, is 30 ft. diameter and has a capacity of 14,000 cu. ft., providing 40 days' storage for 14,000 people at the rate of 25 cu. ft. of fresh sludge per 1,000 people. This tank is heated and equipped with a Downes cover. The other tank is used for temporary sludge storage, has a capacity of 12,000 cu. ft. and is not heated.

The accompanying chart gives the monthly data and averages, with curves showing digestion tank temperatures and gas production. The digestion tank was put into operation during January and February by use of auxiliary heat, the outdoor temperatures averaging below freezing with minimum temperatures below zero. The next three months also continued to be abnormally cool.

The pH values in the tank were at first below 6.6, and during January and February varied considerably in different horizontal sections, and not until April was a uniform pH of 7.4 attained. After this no further liming was required, but up to then 188 bags of lime had been used to condition the sludge.

A small coal heater was installed January 10th but was replaced on January 26th with a vertical type kerosene burner with a capacity of about 2 gal. per hour, or theoretically 270,000 B. t. u. per hour; although the heat reaching the boiler was less than this because the burner deposited a large amount of soot on the boiler. Later, digestion tank gas was used through four grids. The B. t. u. delivery was calculated from the average temperature differential between supply and return water and the amount of such circulated. (No night determinations of this differential were made and a high degree of accuracy can not be claimed for the figures given.)

The gas production was only 7,100 cu. ft. in February but increased rapidly and reached a maximum of 293,000 in June, falling to 284,100 in July, or 0.9 cu. ft. per capita per day, and increasing to 1.27 cu. ft. for the first nine days of August. Delayed digestion during the first two or three months was undoubtedly responsible for the excessive gas production of June



and July. It is expected, however, that the final rate will be above the customary 0.6 to 0.7.

The history of digestion is indicated by the gas curve. The lagging of the temperature of the bottom of the tank in February and March was due to the presence of moving ground water. The low temperature of the top was due to the floating "yellow" sludge, which collects periodically under the cover to a depth of 1 to 4 ft., chills and becomes inactive. The heat from the heating coils which warms the rest of the tank fails to affect this, and a large volume of material which, containing grease and fat, is a greater potential producer of gas than any other sludge, remains inactive. The only method of liquifying and warming this is by jetting or hosing through the dome. A permanent jetter has been installed through one of the outlets of the dome consisting of a 1½ inch brass pipe with nozzle, the riser pipe passing through a stuffing box which permitted the nozzle to be raised or lowered. Jetting this floating sludge was continued during April, the temperature increased and it became gas-producing. Also, black sludge from the bottom of the tank was pumped into the dome and through the fresh sludge inlets.

During May digested sludge was withdrawn from the tank for fear of an over congestion of sludge in the tank resulting from continuous pumping of fresh sludge into the tank since the middle of December. After the first two sludge withdrawals, which were probably premature, gas production decreased and the tank temperatures dropped below 80 degreees, but it was decided to wait for warm weather and not use more kerosene to bring up the temperature. During June, as gas production increased, with resulting increased tank temperatures, an extremely active gas production took place which was not an acid foaming but was the result of sudden gas activity and excessive agitation, due to restored optimum conditions for digestion and a large accumulation of sludge ready for a belated digestion. This activity was so pronounced that foaming ran above the roof, reaching up to the dome, and it was necessary to immediately drop tank temperatures and starve the digestion tank of fresh sludge, which was for several weeks pumped to the storage tank and held there for gradual removal. Seals were continually blown by excessive gas production and it was neccessary to bleed the surplus gas to the air. The meter was too small to measure this surplus, but it is estimated that at its peak the gas production was at the rate of at least fifteen or sixteen thousand cubic feet a day. (A larger meter was installed late in June.) During this period of excessive agitation the bottom sludge thinned out; both black and yellow sludge occurred in any horizontal strata of the tank as either settlement or flotation was inhibited. As the tank quieted down, heat was again applied to the tank, and a normal gas production was restored and recorded.

During the first part of July the gas production registered the delayed effect of starving the digestion tank of fresh sludge. During July the accumulation of fresh sludge delivered to the storage tank in June was gradually withdrawn and pumped to the digestion tank and during the latter part of July, high gas production again obtained. During the month of July the tank temperature curve is ragged due to the intermittent use of heating apparatus. In August there still remained a considerable volume of wet and uncompacted floating yellow sludge and the practice was established of mixing small quantities of this with seeding sludge from the bottom and supernatant liquor and pumping it back to the digestion tank through the regular fresh sludge inlets. This floating sludge is a long way from heavy seeding material, and this procedure is the simplest method of seeding it and changing its location in the tank.

It has been noted that any type of disturbance in the tank materially affects the flow of gas. Pumping to the digestion tank retards the gas flow temporarily, with a subsequent surge of gas several hours later. It may be that a different rate of pumping would smooth out the daily gas production curve and a study of different operating methods is being made.

Fresh sludge has been consistently pumped to the sludge digestion tank since the 20th of December, 1931, supernatant liquor being withdrawn, prior to digested sludge withdrawal, to make room for this. During the early months of operation, the tank conditions as to pH and temperature were apparently better adapted to liquefication than to gas production, and in starting without seeding this early liquefaction provided the capacity required for daily fresh sludge requirements.

Since February 1st, 1932, daily reports have been maintained of various factors of plant operation, together with monthly summaries of these factors.

Since the plant was put into operation, it has not been possible to read in an Imhoff cone any settleable solids in the tank effluent. For this reason, no samples of the influent are taken and samples of the effluent are taken merely as a control to see that this nominal 100% efficiency is maintained.

The conveyor flights return as skimmers and the manual removal of scum has proved to be of no moment. The Saranac Lake sludge is unusually matty and at times rises at the inlet end of the tank but immediately settles again when these matty masses are broken up with a rake. The sludge conveyor is operated for one-half revolution in the morning and one-half revolution in the afternoon.

The measurement of fresh sludge withdrawn daily from the settling tanks is a displacement measurement in the sludge pump-well. A small quantity of ground water reaches this well and a correction of the reported figures is necessary. The adjusted quantities of fresh sludge are subject to further checking but, as corrected, show a daily fresh sludge in the amount of 430 cubic feet a day from an estimated connected population of 10,000 people. In spite of this apparently large per capita figure, it may be said that the sludge withdrawn from the settling tank hoppers is unusually free of "free water." The cylindrical bottom of the sludge pockets has served to concentrate the sludge around the sludge pipe outlet and has materially aided in the ease of blowing off these pockets without the breaking through of sewage.

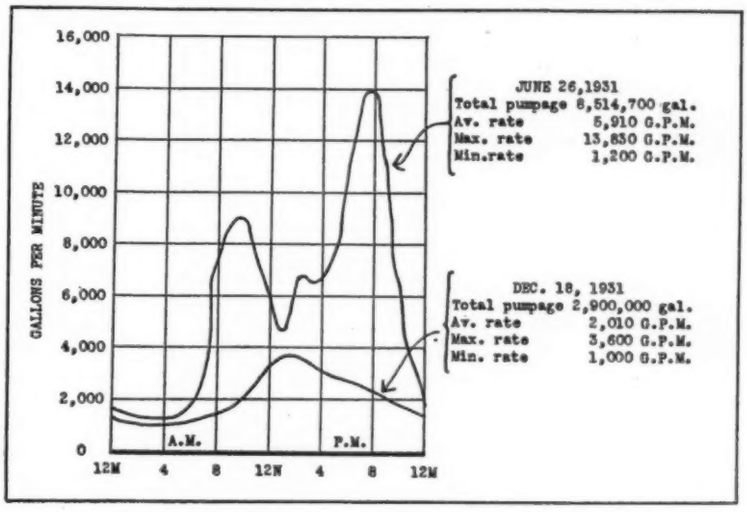
The sludge collectors were furnished by the Jeffrey Mfg. Co., the Downes floating covers by the Pacific Flush-Tank Co., the B-line heaters by H. B. Smith & Co., and the sludge gas meters by the Pittsburgh Equitable Meter Co.

Maximum Daily and Hourly Water Consumption in American Cities

By A. PRESCOTT FOLWELL

Editor of

PUBLIC WORKS



Average winter and maximum consumption in Tucson, Ariz.

In sending us this curve, L. R. Burch says that in summer the peak loads are due to heavy irrigation of lawns and trees before and after the hot hours of mid-day. In winter the consumption is mostly domestic. Pumpage rates are measured by a recording venturi meter and carefully calibrated pitot tube. Individual meters accounted for 81% of the pumpage.

MOST of the available data on monthly, daily and hourly maximum rates of consumption of water in United States cities are rather old or are limited in scope. But such consumption figures, either known or assumed, are necessary in designing almost every feature of a water works plant. The writer believed, therefore, that reliable information of this sort, if it could be secured, would be of real value. Through questionnaires, the periodical of which he is editor secured information from 654 United States municipalities, located in all of the 48 states. The information furnished by a number of these cities was not based on accurate records or was not sufficiently complete to be of value, and for this and other reasons the study was limited to the questionnaires received from 361 cities, all of which appeared to keep accurate records, and most of them to have modern means available for measuring the flow. As reported by the water works officials which furnished them, 75% of the figures were derived from meter readings, 33 1/3% being Venturi's, the others not specified; 18% were from pumping records, and 5½% were estimated. (See Table No. 5).) This group of 361 cities ranged in size from Detroit, Mich., to Helmetta, N. J., which reported a population of 700.

As the study progressed, many problems arose apart from the one of digesting the great mass of information contained in these 654 reports, sorting, arranging, figuring rates and percentages, etc. Because of the great amount of work involved, this paper is little more than a progress report. More time will be required to make a complete study of the data and fill in lapses in the information at hand.

One of the problems was connected with population as a basis of per capita consumption. We might say that any town, for the purpose of such a study, has three populations: The population claimed by the Chamber of Commerce; the population given by the Census Bureau; and the population served by the water department. As population grows more rapidly than the Census Bureau moves, the optimistic figures of the Chamber of Commerce may be approximately correct. (As this study deals with consumption figures for 1931 or 1930-'31, the 1930 Census figures probably are not far wrong, and are used.) The census figures may greatly exceed the consumer figures; some of our southern cities, for example, serve but a portion of their population, a considerable percentage, in some cases, obtaining their supplies from wells and springs. Or, on the other hand, the consumers may include non-citizens. In most of the tables accompanying this paper the rates are figured on the basis of population served as reported by the waterworks superintendent; but in tables No. 2, 3 and 4, Census figures are used.

Month of Greatest Consumption.—Of the 361 cities which furnished sufficient data to form a basis of study, 348 named the month of maximum consumption. The result is given in Table No. 1, from which it will be seen that almost exactly 80% of the cities reporting show their maximum draft to occur in July and August.

Maximum Monthly Consumption.—The maximum monthly consumption varies widely. In Massachusetts, for instance, the lowest reported was 105% of the average, for the month of August for New Bedford; while another Massachusetts city reported 190% of the average, for July. The combined results of the cities reporting, based on the total consumption for the average month and the total consumption of the maximum month, showed that the maximum-month consumption averaged 124% of the average month.

Maximum Daily Consumption.—Seventeen cities of more than 100,000 population gave figures for their maximum daily consumption which it seemed desirable to include in this study. Their populations, numbers of consumers, average and maximum daily consumptions are given in tables No. 2 and 3. The maximum daily per capita consumption of these averages 153% of the average daily, only three exceeding 160% and three being less than 130%.

Figures are given in Table No. 4 for seventeen New England cities of 20,000 population or less, which show a maximum of 166% of the average; but this average is 68 gallons per day, as compared with

117, the average for cities of more than 100,000. The averages of maximum daily consumptions are 110 g.p.d. per cap. for small New England cities and 175 for the large cities.

The percentages for the several districts, in order of magnitude, are: East North Central—196%; West North Central—188%; West South Central—185%; Pacific—175%; Mountain—173%; So. Atlantic—158%; New England—155%; Middle Atlantic—150%; East South Central—149%. The average for the whole United States, 284 cities, is 176%.

Maximum Hourly Consumption.—The number of cities that could give accurate figures concerning the maximum hourly consumption was, of course, rather limited, aggregating 94 for the entire country, after weeding out all the doubtful ones. As might be expected, the variations are wider than in the case of daily maxima. Many things can be considered as influencing this, including major breaks in lines, fires in the case of the smaller communities, use of water by industries, sprinkling lawns and gardens, seasonal tourists, etc.

As is shown in Table No. 5, the maximum rate of consumption per person per hour varies from around 3 gallons per hour up to a maximum of more than 50; but the average is around 14 gallons per hour. Generally speaking, it appears that the maximum hourly rate approximates 310% of the average in most of the cities; and exceeds 400% in twenty-one and is less than 200 in seventeen.

In Table No. 5 the figures for hourly consumption (on the basis of number of consumers) are classified by geographical districts, and further are divided into those of more than and less than 10,000 population; and the averages of figures for each classification are given in Table No. 6. The average per capita consumption in the East South Central States is apparently the least of any section of the country, followed in order by the New England, West North Central and South Atlantic varying but little—between 74 and 78; then the West South Central with 91, Middle Atlantic 107, East North Central 111, Mountain 230, and Pacific 250. Maximum-hour consumption expressed as percentage of the average varies from 220% in the South Atlantic to 371% in the West North Central.

General Summary

Based upon the information as given, it might be conservative to say that in the smaller towns and cities, the maximum daily consumption should not exceed about 200% or 210% of the average, and the hourly consumption about 300%.

In cities of 100,000 population or more, the maximum daily consumption will generally not exceed about 160% of the average consumption; and the hourly maximum consumption will be about 235% of the average rate.

There are, however, so many factors entering into the matter, that it seems to the author that the data above, instead of furnishing arbitrary figures for the bases of design, indicate most strongly the need for a sound study of local conditions in every case. Character of population, living standards, use of the public supply for irrigation or lawn watering, and, perhaps above all, the character of the technical supervision available for operation of the water facilities of the community, need most careful consideration.

How various factors may affect the maximum consumption is indicated by some of the explanations given by various cities. Of twelve cities whose maximum rates seemed to be excessive, 9 attributed them to sprinkling lawns and gardens during unusually dry weather, while the other three named swimming pools on large private summer estates, sewer flushing and a large fire, respectively. Of 5 whose maximum rates were well below the average, 3 attributed this to the fact that a large part of the consumption was by industries whose consumption rate was uniform; while high wastage, and the fact that there were few lawns and sprinkling was confined to a few hours per day, were the reasons assigned by the other two.

In addition to the information herein summarized, we hope to check directly with the water works superintendents figures that depart furthest from the average, and evenually also to check the percentage of services metered against these figures and see what comes from that.

The above paper was read before the New England Water Works Association at Springfield, Mass., September 27th.

Tables to accompany above article

TABLE NO. 1 *Month of Greatest Consumption in 348 Cities*

January	10	May	4	September	17
February	2	June	18	October	6
March	7	July	193	November	1
April	1	August	86	December	3

TABLE NO. 2 *Population Served, Census Population and Daily Per Capita Consumption—Large Cities*

Name of City	*Population By Census Bureau*	*Population Served**	*Daily Per Capita Consumption Tl. Population*	*Consumers*
Detroit, Mich.	1,678,000	1,678,000	144	144
Buffalo, N. Y.	590,000	590,000	192	192
Milwaukee, Wis.	578,000	648,000	146	131
Minneapolis, Minn.	460,000	460,000	122	122
Cincinnati, O.	451,000	500,000	127	114
Louisville, Ky.	308,000	330,000	138	129
Atlanta, Ga.	270,000	300,000	115	103
Providence, R. I.	253,000	320,000	99	77
San Antonio, Tex.	231,000	256,000	99	89
Dayton, O.	200,000	230,000	117	101
Oklahoma City, Okla.	185,000	200,000	74	69
Hartford, Conn.	164,000	208,000	109	87
Flint, Mich.	156,000	156,000	89	89
Springfield, Mass.	150,700	150,700	102	102
Long Beach, Calif.	145,000	145,000	107	107
Tulsa, Okla.	140,000	140,000	129	129
Knoxville, Tenn.	122,500	122,500	72	72
Average			117	109

*As reported by water works official.

TABLE NO. 3 *Maximum Consumption Per Capita Per Day and Per Hour—Large Cities. Census Population*

Name of City	*Daily Max. Gallons*	*%*	*Hourly Max. Gallons*	*%*
Detroit, Mich	215	150	...	...
Buffalo, N. Y.	248	129	...	...
Milwaukee, Wis.	225	154	328	226
Minneapolis, Minn.	272	222	396	324
Cincinnati, O.	191	150	254	200
Louisville, Ky.	188	136	...	...
Atlanta, Ga.	153	133	230	200
Providence, R. I.	127	128	...	...
San Antonio, Tex.	147	149	208	210
Dayton, O.	169	153	...	...
Oklahoma City, Okla.	178	240	247	333
Hartford, Conn.	140	128	213	195
Flint, Mich.	143	161	...	...
Springfield, Mass.	134	131	211	203
Long Beach, Calif.	165	154	...	...
Tulsa, Okla.	186	144	...	...
Knoxville, Tenn.	106	148	156	216
Averages	175	153	249	234

TABLE NO. 4 *Maximum Daily Consumption—New England Cities of 5,000 to 20,000 Population*

Name of City	Population (Census Bureau)	Daily Consumption Average Gal.	Maximum % of Av.
Calais, Me.	5,500	94	139 148
No. Andover, Mass.	6,680	63	116 207
Mansfield, Mass	6,800	67	129 194
Franklin, Mass.	7,000	64	99 154
Turners Falls, Mass.	8,000	102	145 142
Putnam, Conn.	8,000	93	163 175
Hudson, Mass.	8,500	46	88 192
St. Johnsbury, Vt.	9,000	123	167 135
Reading, Mass.	10,500	41	57 141
Amesbury, Mass.	12,000	55	86 156
Needham, Mass.	12,500	58	101 169
Webster, Mass.	12,800	47	65 139
Natick, Mass.	13,400	58	107 185
Danvers, Mass.	13,465	92	173 188
Abingdon, Mass.	14,000	41	94 229
Greenfield, Mass.	15,500	86	103 120
Marlborough, Mass.	16,000	44	72 164
Gardner, Mass.	20,000	43	70 163
Averages	11,091	68	110 166

TABLE NO. 5 *Maximum Hourly Consumption, 96 Cities of All Sizes, by Geographical Divisions, on basis of Number of Consumers*

Name of City	No. of Consumers	Av. Consumption per day per Consumer	Maximum Hourly Consumption Gals. per Consumer	% of Average	How Measured
New England States					
Hartford, Conn.	208,000	87	7.0	192	M
Springfield, Mass.	150,700	102	8.8	200	V
Natick, Mass.	13,400	57	17.9	753	M
Rockford, Mass.	6,000*	58	5.2	216	P
Av., more than 10,000		*76*	*9.7*	*340*	
Putnam, Conn.	8,000	93	10.9	281	P
Hudson, Mass.	7,700	51	5.5	258	V
Av., less than 10,000		*72*	*8.2*	*270*	
Middle Atlantic States					
Shamokin, Pa.	65,000	121	7.7	152	M
Auburn, N. Y.	48,600	116	8.6	178	V
Fulton, N. Y.	12,800	62	5.6	218	M
Herkimer, N. Y.	10,854	77	9.2	288	M
Av., more than 10,000		*94*	*7.8*	*209*	
Ashland, Pa.	8,000	90	6.2	166	E
Beaver, Pa.	5,665	132	20.1	366	F
Catasauqua, Pa.	5,000	140	13.2	226	V
Av., less than 10,000		*121*	*13.2*	*253*	
East North Central States					
Milwaukee, Wis.	648,000	131	12.3	226	V
Cincinnati, O.	500,000	114	9.5	200	P
Rockford, Ill.	89,200	82	10.9	329	V
Saginaw, Mich.	80,600	138	11.9	208	V
Evanston, Ill.	79,700	131	14.2	257	M
Springfield, O.	70,000	159	14.5	220	P
Racine, Wis.	67,500	94	12.0	309	M
Oak Park, Ill.	65,000	94	9.2	235	M
Kalamazoo, Mich.	55,416	93	9.9	279	V
Battle Creek, Mich.	50,000	93	19.6	512	V
Rock Island, Ill.	38,000	104	8.9	212	P
Elgin, Ill.	37,000	60	7.5	300	RD
Ann Arbor, Mich.	36,000	110	18.8	410	HM
Waukegan, Ill.	33,500	120	14.9	304	M
Port Huron, Mich.	32,000	252	28.7	272	V
Middletown, O.	30,000	90	6.9	185	V
Harvey, Ill.	30,000	76	5.5	174	V
Mishawaka, Ind.	27,000	71	12.1	416	M
Wausau, Wis.	20,728	110	12.0	275	M
Bloomington, Ind.	18,000	94	5.7	142	V
Holland, Mich.	15,200	95	22.7	575	P
Cairo, Ill.	15,000	125	12.7	244	M
Escanaba, Mich.	14,516	99	9.6	233	P
Mattoon, Ill.	14,000	77	6.0	187	
Menominee, Mich.	11,000	116	34.1	715	V
Two Rivers, Wis.	11,000	70	13.6	466	V
Watertown, Wis.	11,000	70	13.6	473	V
Ashland, Wis.	10,500	139	24.5	404	P
Whiting, Ind.	10,175	265	19.6	180	V
Ypsilanti, Mich.	10,000	111	13.5	293	P
Av., more than 10,000		*112*	*13.7*	*309*	
Menasha, Wis.	9,200	194	19.6	256	M
Conneaut, O.	8,460	150	12.0	189	V
St. Joseph, Mich.	8,341	110	20.0	450	P
Sturgis, Mich.	8,000	100	17.2	419	M
Kaukauna, Wis.	6,581	40	9.0	550	M
Madison, Ind.	6,522	213	22.1	250	M
Petoskey, Mich.	6,500	91	18.5	495	V
Lebanon, Ind.	6,000	69	7.5	259	M
Lake Forest, Ill.	5,600	262	53.4	496	V
Wilmington, O.	5,400	36	7.3	493	P
Vandalia, Ill.	5,000	85	12.0	340	P
Orrville, O.	4,600	73	10.0	332	P
Stoughton, Wis.	4,500	56	11.2	487	SM
Montpelier, O.	3,800	93	13.8	356	E
Medina, O.	3,400	73	8.9	291	P
Av., less than 10,000		*110*	*16.2*	*377*	
West North Central States					
Minneapolis, Minn.	460,000	124	16.5	320	M
Duluth, Minn.	101,000	95	8.5	212	V
Sioux City, Ia.	80,000	78	6.0	188	M
Springfield, Mo.	70,000	60	4.1	163	V
St. Cloud, Minn.	21,000	54	19.0	874	M
Rochester, Minn.	20,600	54	6.1	270	M
Winona, Minn.	19,000	80	20.8	632	V
Beatrice, Neb.	10,000	81	12.0	355	M
Av., more than 10,000		*78*	*11.6*	*377*	
Centerville, Ia.	8,600	58	4.2	140	M
Fulton, Mo.	8,000	52	8.0	370	M
Carrol, Ia.	4,000	97	12.0	296	M
Av., less than 10,000		*69*	*8.1*	*269*	
South Atlantic States					
Atlanta, Ga.	300,000	103	8.6	200	M
Greensboro, N. C.	45,000	90	7.4	197	M
Raleigh, N. C.	40,000	82	8.3	212	V
Orlando, Fla.	27,000	90	7.7	206	M
Gastonia, N. C.	20,000	69	5.0	175	V
Av., more than 10,000		*87*	*7.4*	*198*	
Kings Mountain, N. C.	5,000	57	8.0	335	V
Cheraw, S. C.	3,575	57	4.7	197	E
Av., less than 10,000		*57*	*6.3*	*266*	
East South Central States					
Knoxville, Tenn.	122,500	72	6.5	216	V
Canton, Miss.	4,750	50	8.8	457	P
West South Central States					
San Antonio, Tex.	256,000	89	7.8	210	M
Oklahoma City, Okla.	200,000	69	8.3	288	V
Wichita Falls, Tex.	40,000	90	10.4	277	M
Av., more than 10,000		*83*	*9.6*	*272*	
Blackwell, Okla.	8,500	157	23.5	360	M
Crockett, Tex.	4,600	45	3.2	173	M
Av., less than 10,000		*101*	*13.3*	*267*	
Mountain States					
Tucson, Ariz.	36,000	130	23.0	433	M
Missoula, Mont.	16,000	528	43.7	200	M
Twin Falls, Ida.	11,000	269	27.3	244	M
Av., more than 10,000		*309*	*31.3*	*292*	
Roswell, N. M.	9,000	185	20.0	260	V
Alamosa, Colo.	4,000	120	18.8	375	P
Av., less than 10,000		*152*	*19.4*	*317*	
Pacific States					
Tacoma, Wash.	108,100	311	27.3	209	E
Sacramento, Calif.	87,000	270	24.4	217	V
Anaheim, Calif.	12,000	108	19.1	431	M
Marshfield, Ore.	10,000	119	13.2	221	V
Av., more than 10,000		*202*	*21.0*	*270*	
Lodi, Calif.	7,500	357	53.4	360	P
Red Bluff, Calif.	4,000	355	45.0	305	E
Av., less than 10,000		*356*	*49.2*	*332*	

E—Estimated. F—Electric flow meter. M—Metered. HM—House meters. P—Pumpage. RD—Reservoir displacement. SM—Station meters. V—Venturi meter.
*Permanent population, 4,000; summer (3 months) 12,000.

TABLE NO. 6 *Maximum Hourly Consumption. Averages, by Districts, of Places of More Than and Less Than 10,000 Population*

District	Average Consumption per day Gallons per cap. More than 10,000	Less than 10,000	Maximum Consumption per hour Gallons per cap. More than 10,000	Less than 10,000	% of Average More than 10,000	Less than 10,000
New England	76	72	9.7	8.2	340	270
Middle Atlantic	94	121	7.8	13.2	209	253
East North Central	112	110	13.7	16.2	309	377
West North Central	78	69	11.6	8.1	377	269
South Atlantic	87	57	7.4	6.3	198	266
East South Central	72	50	6.5	8.8	216	457
West South Central	83	101	9.6	13.3	272	267
Mountain	309	152	31.3	19.4	292	317
Pacific	202	356	21.0	49.2	270	332
United States	115	117	13.3	15.4	298	330

Refuse Disposal in Akron and Sharon

Our attention has been called to an unfortunate mixup in two recent articles, one, published in July, dealing with street cleaning and rubbish collection in Akron, O.; the other, published in the September issue, with garbage disposal costs in Sharon, Pa. A table giving costs of operating the Sharon incinerator, which should have formed part of the latter article was, though some mischance, appended to the former. As a matter of fact, Akron has no incinerator but feeds its garbage to hogs.

We apologize to both Akron and Sharon, and hope that all who read those articles will see this correction.

Preparing the Surface

Sweeping

First Application

Bituminous Surface

A Cheap and Simple Way

Third in a series of articles on

SURFACE treatment may be applied to earth surfaces or to surfaces that have already had some degree of improvement, such as sand-clay, chert, shale, gravel (either loose or consolidated), cinder, slag or macadam. In this article, discussion will be limited to other than earth surface treatment, and to original treatments. In general, costs for surface treatments will run from $1,000 to $1,500 per mile, originally. Thereafter, the road can be kept in good condition with average costs of around $400 per mile. In PUBLIC WORKS, August, 1931, the methods employed for surface-treating roads in Maine were described, the costs on this work being somewhat less than the costs given above. A number of other articles have also appeared, describing methods employed in various other parts of the country.

Surface treatment should not be classed as construction, but as maintenance. It permits the wear originally carried by the road material to be transferred to a light covering which is renewable and maintainable; it lays dust, or eliminates it, prevents erosion and loss of road material; and it waterproofs the surface. It also provides, at a small cost, a smooth-riding surface available to tax-payers and citizens all the year round.

The original surface must have the strength and stability to carry the loads that will come upon the road. Surface treatment does not add materially to the capacity of the road to bear heavy traffic.

Drainage and proper preparation of the road for surface treatment are most important, and the majority, by far, of the disappointments that occur in this work are due to insufficient or improper preparation. Mistakes or careless work in preparing the surface or draining a highway obstinately refuse to be buried permanently by surface treatment, and it is a waste of time and money to attempt to bury them.

In the preparation of the road, no matter what materials or what methods are employed, drainage comes first. Following this, the road should be patched and smoothed, if this is possible to do satisfactorily, reshaped and necessary new material added. If the surface is in bad condition, it ought to be scarified, reshaped and rolled. A firm, smooth, properly graded and shaped surface is necessary for satisfactory and lasting surface treatment. It is generally desirable to complete this work somewhat in advance of the time when it is planned to start surface treatment.

Equipment for surface treatment will include, as a minimum, a pressure distributor, a stone spreader, a broom drag and a roller, plus the necessary trucks for hauling.

The method of constructing the surface treatment layer depends somewhat upon the material used, whether asphalt, tar or asphalt emulsion. In order that our readers may have exact information on the proper method of construction, the following data have been furnished specially to us by the engineers of the various companies manufacturing such materials, and are here summarized and arranged for easy use.

In the data given, all quantities are *per square yard,* whether they refer to application of bituminous material or to covering with stone chips or gravel.

American Bitumuls Co.:

After the preliminary preparation, the roadway is given an application of quick-setting emulsion applied cold at the rate of .25 to .45 gallon. This is immediately covered with crushed rock or crushed gravel, ¾ to ¼-inch, applied at the rate of 25 to 30 pounds. This may be accomplished by spreaders attached to trucks which should follow within 200 feet of the distributor. Immediately after spreading, it is distributed uniformly with the aid of broom drags which, with three sets of transverse brooms, produce a smooth uniform riding surface. Immediately after brooming the surface is rolled to bed the crushed rock into the fresh emulsion.

A second application of quick-setting emulsion is then made of .25 to .35 gallon

The broom drag distributes the cover uniformly.

Distributing Cover

Rolling

A Finished Road

Treatment Methods

to Improve Secondary Roads

Low Cost Bituminous Roads.

and is covered at once with 15 to 18 pounds of stone chips (all passing a ⅜" screen and 80% to 100% retained on a ⅛" screen). The second application is spread in the same way as the first, and the road is then opened to traffic. This type of surfacing requires .50 to .75 gallon of quick-setting emulsion and a total of 40 to 45 pounds of stone chips. The cost has ranged from 12 to 18 cents per square yard.

When roads are not sufficiently compacted to permit of thorough sweeping, the existing surfacing is dragged or bladed to a proper section, and an application made of emulsified asphalt primer or a light asphaltic oil of the priming grades. This is allowed to penetrate, the surface being kept dragged until compacted under traffic. A single application of emulsified asphalt is then made at the rate of .30 to .40 gallon and covered with 25 to 30 pounds of stone chips, ½-inch to 10-mesh. The chips are drag broomed and rolled. This type of treatment costs from 9 to 15 cents per square yard.

The Asphalt Institute:

After the surface has been prepared and swept carefully with a rotary broom, .25 to .33 gallon of cutback asphalt similar to No. 5, which has a viscosity of 15 to 30, is applied, usually to one-half of the surface at a time. After 2 to 4 hours, a second application of quick-setting cutback asphalt, also similar to No. 5, is applied at a rate of .33 to .50 gallon and covered with 35 to 50 pounds of chips, followed by brooming and rolling.

In those cases where the surface material is loose, the surface is bladed and graded to an even and true section, and then swept lightly—not hard enough to disturb firm underlying material. The initial application for priming is .50 gallon No. 2 cut-back asphalt, This will penetrate to a depth of about 1½ inches. The loose material previously swept to one side is then used as a cover, and the road is dragged. After a few days the surface will appear well bonded. A second application of .25 to .33 gallon of quick-drying cutback asphalt No. 5 is followed by a cover coat of 25 to 30 pounds of chips or other suitable material. The surface is then rolled to set the bottom particles of the cover coat aggregate, after which rolling and dragging are carried on until a smooth and uniform surface is obtained.

When using cinder or slag, the quantity of asphalt should be increased from 25% to 50%.

The Barrett Co.:

On gravel roads hard enough to be swept and which, when swept show a fair amount of aggregate above ¼ inch, after shaping, etc., sweep the dust and loose material from the surface. Apply Tarvia-B at the rate of .17 to .25 gallon. If the road must be left open to traffic use the lighter application with a light sand cover; if it can be closed, use the heavier application without cover. After 24 hours, add enough more Tarvia-B to make a total of .50 gallon. Cover immediately with coarse sand, sandy gravel, pea gravel or stone chips, using only enough cover to prevent picking up—from 50 to 80 yards per mile of 18-foot road.

When there is considerable loose material on the road, spread this material evenly over the surface, and apply .33 gallon of Tarvia-B. Allow it to soak in for 2 to 24 hours. Move the treated material from one side of the road into a windrow a little beyond the center of the road. Apply .33 gallon Tarvia-B to the exposed solid surface, move the windrow back onto this wet surface, and treat the other side. Spread the treated material evenly over the road and smooth with a drag, continuing to drag or blade until the road sets up, which may be 2 to 10 days. Then give a seal coat of .17 gallon of Tarvia-B and cover as above. It is good practice to delay the application of the seal coat until the road has consolidated under traffic.

With macadam, after reshaping, patching holes, or scarifying and adding new stone as necessary and rolling, apply .33 gallon Tarvia-B, or more if the road will absorb it, brooming out puddles. New roads or open roads may require .50 gallon, which is best applied .25 gallon at a time. Two hours after the last application, cover with clean stone, slag chips or pea gravel, using 20 to 25 pounds. Subsequent treatments may require less cover. Tarvia-A may also be used at the rate of .33 gallon and covered with clean stone chips or pea gravel, when the original surface is hard clean stone. For softer stone, applications of .25 gallon of Tarvia-B followed after 24 hours with ¼ gallon of Tarvia-A, and covered with stone, slag chips or pea gravel, gives fine results.

Dragging Gives Excellent Riding Qualities

Headley Emulsified Products Co.:

Surface treatments are either single or double; the former is used on a hard, durable surface that is in need of sealing; the double treatment is generally used on surfaces not compacted, but when used on thoroughly compacted surfaces is generally referred to as "armor coat."

Single Treatment: Apply .25 to .50 gallon of emulsified asphalt, depending on the surface; then cover with clean hard stone, slag or gravel, ⅜ to ¾-inch, in quantity proportional to the amount of emulsion used, or about 15 to 40 pounds. The surface is then rolled, or broom-dragged and rolled. This type of treatment is employed as a protective for seal covering, and also provides a non-skid surface.

Double Treatment: Apply as a primer, .25 to .40 gallon of emulsion, and cover with 10 to 20 pounds of aggregate to assist in stabilizing the loose base material. Roll, or broom-drag and roll the surface. The second application should be of .25 to .50 gallon, depending upon the surface character. This should be covered with clean hard stone, slag or gravel, ⅜ to ¾-inch, the amount proportional to the amount of emulsion used, or about 15 to 40 pounds. The surface is then rolled, or broom-dragged and rolled.

Shell Eastern Petroleum Products Co., Inc.:

In addition to thorough sweeping, it may be found desirable to wash the road and even to scrub off mud caked on the surface. Water used in cleaning assists the Colas in adhesion. Application of Colas is best done with a distributor; the amount required depends upon the road surface, generally from .25 to .33 gallon. As soon as the emulsion is applied, and before it has had time to "break," the surface is covered with a layer of stone chips or pea gravel, using 20 to 30 pounds. On surfaces treated with .33 gallon, use ½ to ¾-inch chips, and for the lighter treatments, ¼ to ½-inch chips. Insure even spreading by the use of a broom. Immediately after the chips have been spread, roll but not heavily enough to crush the chips. Traffic can use the road as soon as the work is completed. It is often an economy to follow the first treatment with a further light treatment.

The above treatment will be all that is required on smooth surfaces. On rougher roads and on gravel roads, two applications are desirable, the first of .33 to .50 gallon, followed by an application of 25 to 30 pounds of stone chips, smoothed and rolled; the second of .25 to .33 gallon, also covered with stone chips, 25 to 30 pounds per yard, and rolled.

Standard Oil Co. of Indiana:

After the road surface has been repaired, reshaped and cleaned, it is ready for surface treatment. Three types of treatment are available, light, medium or heavy. The light treatment is as follows: Apply .15 gallon cut-back asphalt and follow with a cover of 22 pounds of stone chips B-2 (all passing a ¾-inch screen, not less than 30% passing a ½-inch screen, and none passing a 20-mesh screen). This is followed with .10 gallon of cutback asphalt. Application should be by distributor.

The medium surface treatment provides for a first application of .20 gallon of cutback, followed by 35 pounds of aggregate B-1 (100% passing a ¾-inch screen, not less than 90% passing a ½-inch screen, and none passing a 20-mesh screen). A second application of cutback of .20 gallon is then made, followed by a third application of .10 gallon, after which the surface is covered with 10 pounds of stone chips.

The heavy treatment begins with .30 gallon of cutback, followed by a cover of 30 pounds of B-1 material, with two more applications of .30 and .15 gallon respectively of cutback, and a final cover of 10 pounds of mineral aggregate.

Porous aggregate, if highly absorbent, will require the use of somewhat more cutback than the quantities given above; and the asphalt sets up somewhat quicker so that work must be speeded up. Complete mixing on the roadway is necessary. The aggregate should be dragged to a smooth and uniform riding surface before the asphalt sets up. Traffic will iron out the roadway to a smooth texture in a short time. Traffic bound roads having loose material will require a penetrating coat, such as cutback asphalt ACG, of about .25 to .30 gallon.

Koppers Products Co.:

Tight surfaces are successfully treated with a double application of light tar having a specific viscosity of 8-13 or 13-18, applied at a temperature of about 90°F. The first application consists of .25 to .50 gallon, the tar being allowed to penetrate without cover. Four to twelve hours later, a second coat of light or medium viscosity tar is applied at the rate of .25 to .33 gallon, and covered with about 25 pounds of ½ or ¾-inch crushed stone, slag or gravel, or pea gravel. By dragging the surface with a long base drag, thorough mixing is obtained and slight depressions removed. It is desirable to roll when setting up begins. This treatment costs 9 to 14 cents a yard.

Another treatment, which builds up a thicker bituminous surface is a double treatment as follows: Light tar, .25 to .33 gallon, not covered with aggregate, but followed by .33 gallon hot application at 180°F. This is covered with 35 pounds of aggregate passing a 1-inch screen, or ¾-inch washed gravel. This is not dragged, as a rule, but broomed to distribute the cover material. The cost is 12 to 18 cents a yard.

Loose surfaces are treated in the same manner after a preliminary priming coat of tar.

By the simple methods described above, and at a cost of about 10 to 18 cents per square yard, any county, township, state or city can enjoy smooth-riding roads that will carry the usual traffic to be expected on secondary roads.

Detailed information on methods and materials may be obtained by writing to any of the companies mentioned herein; or this magazine, on request of readers, will send specifications for asphalts, tars or emulsions for use in surface treatment, or will provide directions for doing the work, if the type of material to be used is specified.

Seal of Registered Engineer Required on Sewerage and Waste Disposal Plans

The following letter has been sent by the New York State Department of Health to engineers doing work in that state:

Dear Sir:

Your attention is called to the necessity for placing your seal on plans submitted to this department for approval.

The amended law in relation to the practice of professional engineering and land surveying requires that plans, specifications, plats and reports prepared by or under the supervision of a licensed professional engineer or land surveyor shall be stamped with his seal when filed with public officials. It also provides that no official of this state, or of any city, town or village therein, now or hereafter charged with the enforcement of laws, ordinances or regulations relating to the construction or alteration of buildings or structures shall accept or approve plans or specifications that are not stamped with the seal of a licensed architect or licensed professional engineer.

We would request, therefore, that in the future plans and specifications for sewerage, or sewage and waste disposal systems submitted to this department for approval be stamped with the required seal.

C. A. Holmquist.
Director, Division of Sanitation.

Orange for Highway Striping in Wyoming

The Wyoming Department of Highways last year applied paint for centerlining highways by hand, but carried on research work to determine both the best method of application and the best type of paint. This year, the Department uses a mechanical device of the DeVilbiss type, which applies a spray of paint between two discs set 5 inches apart. This equipment can be attached to the running board of a truck, with sufficient paint to operate for a day. Orange was the color selected.

Stripes are employed only on horizontal or vertical curves where the visibility is limited. With the average number of curves, three gallons of paint are required for each mile of road.

Estimating Flood Crest Run-off

By S. L. Moyer

THE flood-crest run-off likely to accumulate at a given outlet presents an engineering problem that must be considered and settled in some fashion before we can proceed to the design of bridges, culverts, spillways, floodways, storm sewers, drains or other waterways to accommodate the flow.

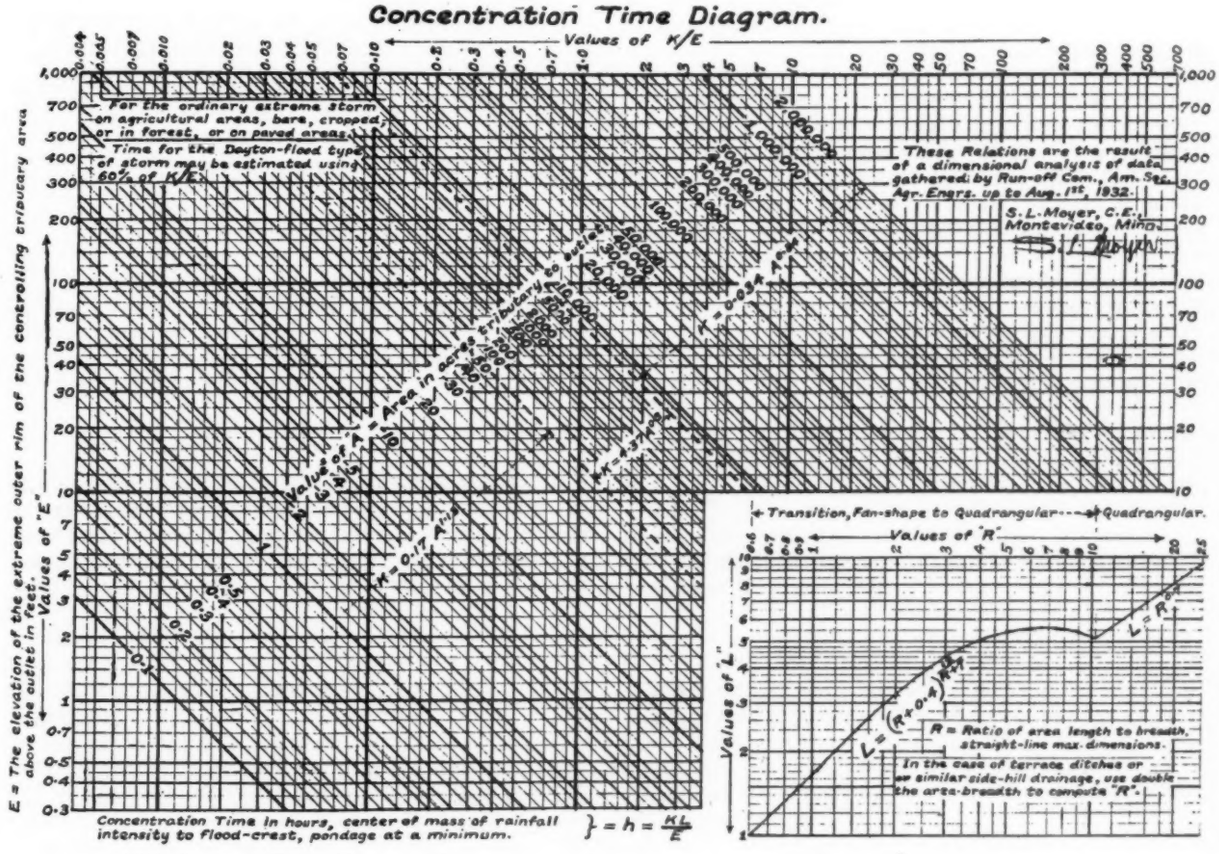
Handicapped by sketchy and contradictory technical flood-flow formulations, engineers usually have been forced to settle this question of waterway capacity largely by resorting to the expedient of judgment. The precedents set by the pioneer structures, hearsay regarding flood stages or prior waterway performance or even more indefinite elements have thus contributed to our determinations of proper size by judgment. Early railroad engineers recognized fully the dangers of this process, but it seems quite possible that many of the present and rising generation may have been tempted to yield to the very human inclination to regard such judgment as beyond reproach.

"Run-off from Small Agricultural Areas" by C. E. Ramser, published in 1927 (a), may be said to be the first truly analytical examination into the subject of flood-crest run-off. Under the inspiration and leadership of Mr. Ramser, a small group of engineers in the Am. Soc. of Agr. Engrs. have been making efforts to extend this line of inquiry with some success. Most of this group are research men, but in 1929 when the Expectancy Method of relating run-off to rainfall (b) had gained a hearing, the writer was drafted into this group as chairman, a position to which Mr. Ramser has since succeeded, the writer now serving as correlation worker for the group. Correlation of data in this project has been undertaken by the writer's expectancy method and by means of the principles of dimensional analysis (c) wherever applicable. The raw data have been obtained by direct observation of the phenomena.

It is necessary to state that this presentation is made entirely on the writer's own responsibility, the verification being still insufficient to warrant endorsement by the group. Between 1918 when the data were gathered and 1927 when the first citation was published, there was a lapse of nine years, and as a practical man the writer is impatient of the waste that goes on while such information is withheld. Wherefore, feeling that this showing may enable practical engineers to arrive at sounder conclusions, the writer, personally, assumes the risks incident to a somewhat premature statement.

Regarding a drainage area of a certain size, a variation in the height through which the water drops in its flow to the outlet exerts a very marked influence on the

(a) Journal of Agricultural Research, Vol. 34, No. 9, pp. 797-823, U. S. Govt. Ptg. Office, 1927.
(b) Trans. A. S. C. E., Vol. 93, pp. 907-919, part of the Symposium on Mississippi River Flood Control.
(c) See Hydraulic Laboratory Practice edited by John R. Freeman, pub. in 1929 by Am. Soc. of Mech. Engrs.



time required for flood waters to accumulate into a crest. Likewise, a variation in the shape of such an area modifies the spread between rainfall cause and flood-crest effect when considered with respect to the procession of time. This spread between cause and effect or concentration time determines the significant unit interval against which rainfall intensities may be measured to evaluate the quantitative cause. Whatever may be the various times of concentration in response to changes in slope or shape for a given area, for the ordinary extreme storm, it appears that the flood crest discharge tends to bear a fairly constant ratio to this significant rainfall rate.

Notation:

I = The maximum rainfall intensity in inches per hour, measured at a given gage and covering a unit interval equal to the concentration, an interval antedating the lapse between cause and effect so as to include the rise and fall of the significant intensity.
C = The run-off coefficient or net effect of all factors influencing the relation of flood-crest discharge to "I" in direct ratio, including the probable variation in the intensity of the several rainfall contributions responsible for the flood crest.
D = A deduction factor representing soil or other retention in inches per hour.
Q = The flood-crest discharge in cubic feet per second.
h = The concentration time in hours, center of mass of rainfall intensity to flood-crest.
A = The area in acres tributary to the outlet.
R = The ratio of area-length to area-breadth, straightline maximum dimensions. (In case of terrace ditches or similar side-hill drainage, use double area-breadth.)
E = The elevation of the extreme outer rim of the controlling tributary area above the outlet in feet.
K = A factor representing the influence of area on time.
L = A factor representing the influence of shape on time.

Types of Storms

For the purposes of relating flood-crest discharge to rainfall, the trend of the data suggests that storms in the Mississippi basin may be conveniently divided into three classes: The usual common-place type, the ordinary extreme type and the Dayton-flood type. The first has no flood significance. The ordinary extreme type seems to contain one or more vortices of intensity with the dominant high intensity center affecting about 50 acres of ground, while there is a rapid fading-out of intensities outward from the center. The Dayton-flood type, as nearly as may be judged at this time, is a variant of the ordinary extreme storm, in which a rapid succession of similar high-intensity centers takes place, within a time 2h to 4h, occurring in such a way that high intensity contributions tend to synchronize in arrival at the outlet. This type of occurrence is sometimes encountered, especially in those regions situated south of the latitude of Chicago.

Considering the array of elements listed in the Notation, it may be said that "I" depends on "h" (after a curve has been compiled from local rainfall intensities); that "C" depends on "A"; that "D" depends on "h" and "A"; and that "h" depends on "A" and "R" and "E." After "I", "C", "D" and "A" have been found, "Q" may be determined by

The General Run-off Formula $Q = (CI-D)\,A$ (1)

Ignoring the possible effect of pondage, for the ordinary extreme storm on agricultural areas, bare, cropped, or in forest, or on paved areas;

Concentration Time $h = \frac{KL}{E}$ (2)

For the Dayton Flood type on agricultural areas

Concentration Time $h = \frac{3KL}{5E}$ (3)

Under 50 acres $K = 0.17\,A^{1.13}$ (4)

from 50 to 8000 acres $K = 4.37\,A^{0.3}$ (5)

8000 to 2,000,000 acres $K = 0.034\,A^{0.84}$ (6)

(4) may be said to show the retardation effect within the major storm center due to the disturbance created by the entrance of numerous contributions. (5) shows the speeding up that may be expected as these disturbing elements cease or fade-out in the case of larger areas. (6) is believed to reflect the effect of the widespread storms responsible for flood crests on still larger areas. It is interesting to observe that (4) and (6) become identical on a circular spot 15 feet in diameter, indicating the lower limit of disturbance in (4) and (5).

With "R" less than 10.4 $L = (R+0.4)^{\frac{12}{R+7}}$ (7)

With "R" 10.4 or more $L = R^{0.7}$ (8)

The variable exponent in (7) may be said to reflect the transition from fan-shape to quadrangular characteristics, while (8) interprets the situation after quadrangular conditions have been attained. The more recent modifications in these statements of relations have been developed from small area data, including terrace ditches, and time for long and narrow natural areas may be somewhat greater than these statements indicate. The areas from which (2) to (8) have been developed are reasonably free from pondage, the effect of pondage being still undetermined.

For the ordinary extreme storm occurring on agricultural areas having average or normal vegetation.

Under 50 acres $C = \frac{0.63}{A^{0.042}}$ (9)

50 to 14,000 acres $C = \frac{1.29}{A^{0.225}}$ (10)

over 14,000 acres $C = \frac{0.192}{A^{0.025}}$ (11)

For the Dayton-flood type of storm

Under 50 acres $C = \frac{0.929}{A^{0.0068}}$ (12)

Over 50 acres $C = \frac{0.97}{A^{0.018}}$ (13)

Of these coefficients (9) to (13), those for the ordinary extreme storm, and more particularly for the smaller areas, are considered the most authentic. For bare ground conditions, in the case of the ordinary extreme storm, higher coefficients may be met, possibly midway between (9) and (12), an excess of one third over (10) being found on 68 acres at Pullman, Wash. The Dayton-flood type on small areas generally flattens the vegetation so that bare ground conditions are approximated. Forest cover, when in excess of 50 percent of the whole area, shows coefficients on small areas of 60 percent of (9), but data are scant. For lower percentages of forest area, however, the showings are quite erratic.

(Continued on page 37)

Developments in Sewage Treatment With Ferric Chloride

By Robert Newton Clark

Sanitary Engineer, Innis, Speiden & Co., New York

IN the problem of sludge drying, ferric-chloride is rapidly assuming an important role. It has been accepted already as the most efficient conditioning agent, from the standpoint of quantity and cost, for any method of drying. In the field of sewage coagulation it is fulfilling another dominant need. Its remarkable rise in favor in the sewage treatment field has been due to four primary factors: lowered prices; increased knowledge of the action and effect of coagulation; improved methods of handling and control of flocculation; and recent greatly increased interest on the part of operators and research workers.

Conditioning Sludge for Mechanical Filtration

The use of ferric-chloride for conditioning excess activated sludge before application to mechanical filters has been tested thoroughly at several major installations. Among these may be mentioned Milwaukee, Indianapolis and Chicago, where uniformly good results have been maintained under actual operating conditions. Recently completed experiments with sludge drying problems at Columbus, Ohio, and Baltimore, Md., have shown that any digested sludge can be prepared for mechanical drying even more economically than can excess activated sludge. At these plants regular filtering units were installed for test purposes, and complete studies made under varying conditions to determine the best type of sludge treatment, and the results that might be expected in practice. The data at hand show that sludge conditioning and mechanical filtration benefit plant operation, and result in very definite economies. (A list of articles giving the data referred to above will be sent on request.)

Aids Sludge Drying on Beds

With sand drying beds also a great improvement in the drying quality of sludge is obtainable by treatment with ferric-chloride. It has been demonstrated that excess activated sludge can be dried rapidly (sometimes within two or three days) on sand beds, when treated with a coagulant. A number of operators are working on the problem of drying digested sludges, to determine the possible saving in sand bed area, and tests already completed and soon to be available give promise of entirely satisfactory results, from the standpoint of operating procedure and economy. There is also a prospect that such a coagulant will aid in drying other by-products of sewage treatment which are apt to present an annoying disposal problem at certain plants.

Ferric-chloride is particularly suited to the small plant, since it appears that exact control of the amounts of coagulant added is not necessary, though it is desirable to regulate doses within reasonable limits for the sake of economy. Several methods of control have been used which are applicable to any type of sludge which can be treated. Hydrogen-ion control is generally accepted in the treatment of excess activated sludge, the practice being to add ferric-chloride in sufficient quantities to maintain a pH of about 3.7. On the basis of active $FeCl_3$ to the dry solids treated, the resulting ratio is approximately 8%, although the figure may vary from 5% to 12% depending upon various factors. For digested sludge there is some question among experimenters of the advantage of definite pH control. While it has an unquestioned value, ordinarily a running check is made with a Buchner funnel or centrifuge to determine the best amount of coagulant.

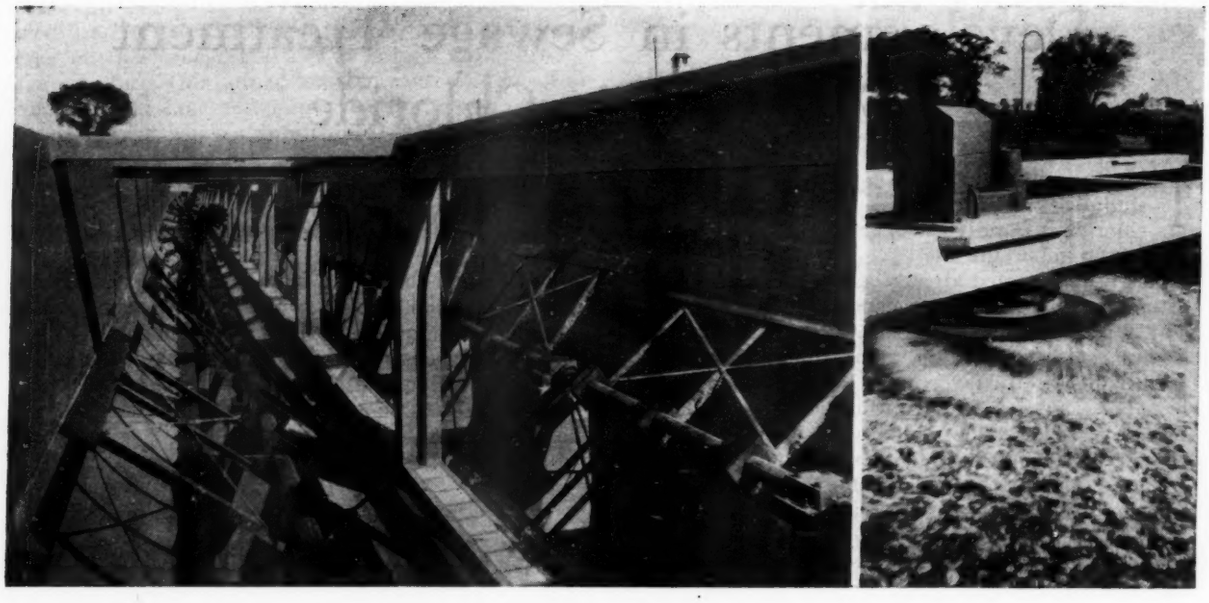
Results in Chemical Precipitation

Chemical precipitation of sewage solids in the past has had a rather unsatisfactory history—an experience which it has in common with many systems of treatment which today have found general acceptance. There is little doubt that past methods had their faults, but a better understanding of the mechanism and control of coagulation have led to a distinct shift in the attitude of those responsible for sewage treatment. An appreciation of the effects of various chemicals, the use of definite control such as pH or tubidity measurements, and the employment of mechanical equipment for mixing and flocculation, have placed the whole subject on a different basis, and results already indicated have awakened new interest in modern precipitation processes.

There are certain advantages in chemical coagulation over and above ordinary sedimentation that appeal to plant operators and engineers. It provides an inexpensive and effective method of dealing with plant overloads, which has particular interest in these times when costly plant improvements are necessary but not forthcoming. The chemical precipitation process is subject to exact control and can be used to deal with seasonal or even daily fluctuations in organic load. This flexibility results in economy of operation since the process need be used only during definite periods, and can be reduced or discontinued when the need is over. The process is of particular interest to plants which receive industrial sewage such as cannery, packing-house or other trade wastes. Such loads are seasonal and cause aggravating upsets in biological treatment methods, especially when acid conditions exist. A great advantage in ferric-chloride is that coagulation can be secured with either acid or alkaline reactions, and the use of lime to correct sewage acidity might assist flocculation and decrease the amount of coagulant needed.

Ferric-chloride has been used successfully to effect a high removal of solids from concentrated sewage, such as packing-house wastes containing as high as 500 ppm of suspended solids and a B.O.D. of about 2000. It seems to be most effective when sewage contains a relatively high percentage of colloidal matter, and when sewage reaches the plant in a reasonably fresh condition. In many cases it will provide a pretreatment of industrial wastes before they are admitted to the common sewerage system.

(*Continued on page 35*)



One of six Dorrco duplex aerators at Phoenix, Ariz. Single row of diffusion plates between two sets of paddles.

Simplex aerator at Monroe, Wis.

Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell
Editor Public Works

V—Activated Sludge Treatment

THE activated sludge treatment involves the use of equipment for applying air to the sewage in small bubbles under low pressure or in some other way that will effect absorption of air by the sewage; separating the suspended matter from the liquid; and returning some of the activated sludge to the raw sewage and disposing of the remainder.

Aeration

Until a very few years ago practically all plants in this country applied the air by forcing it, by means of compressors or blowers, through porous diffuser plates set in the bottom of a tank under 10 to 15 feet depth of sewage. In the early plants the plates were set in longitudinal rows uniformly spaced across the bottom of the tank, but in most later ones, one to three rows are placed along one side wall, creating a spiral flow of the sewage as the air rises along this wall. Only a small part of this air is absorbed by the sewage, the purpose of the excess amount being to agitate the sewage. Ordinarily from 1 to 1½ cu. ft. of air per gallon of sewage is applied, under a pressure of slightly more than ½ pound per foot depth of sewage.

Some recent plants have applied the air through tubes of porous material suspended about mid-depth between the side wall and a longitudinal baffle.

Several of the smaller plants during the past three or four years have used mechanical aerators, whereby the sewage is mixed with the air immediately above it. A few have combined the methods, applying a small amount of air under pressure through plates or tubes and mixing it with the sewage by means of mechanical agitators.

Diffuser Plates and Tubes—Until four or five years ago all porous plates used were made of silica sand bonded together with a synthetic silicate and known as "Filtros" plates. Another plate, the Norton porous plate, has been used in a number of recent plants; this being made of electrically fused alumina grains, bonded together with a highly aluminous glass. Quite recently the Carborundum Co. has put on the market a diffuser plate made of "fused crystals of aluminum oxide," which it calls the "Aloxite" brand. Both of these two firms also furnish tubes of the same material.

The standard size of porous plate is 12″ x 12″, the filtros plates being 1½″ thick and the other two 1″ thick. The standard size of tube is 3″ internal diameter, walls ⅝″ thick, length 24″.

The permeability of the plates is expressed as the number of cu. ft. of air that will pass through a dry plate per minute under a pressure equivalent to 2 inches of water. Until recently 13 to 18 cu. ft. was specified, but ratings of 30 to 35 are becoming common. The size of air bubble may vary also; large bubbles waste air, but keep the sewage agitated and thus prevent settling of solids.

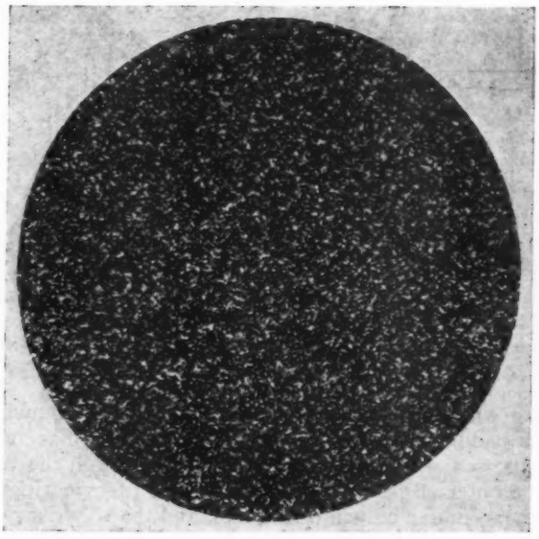
The plates are usually fastened in place with portland cement, but Halowax, pitch, paraffin, lead wool, etc., may be used. In using cement, saturate the plates with water first, as they absorb water with great avidity. After being set, they should be protected from

dirt or oil until put into use. To test tightness of joints, run a few inches depth of water onto the tank bottom, turn on the air, and inspect for bubbles.

In use, the plates may plug up with solids, as by deposits of feric hydroxide from alkaline sewage containing ferrous sulphate; or, on the under side, with dust or soot from the air that passes through, or rust from the air lines. The top surface may be cleaned by scrubbing with a hyrochloric acid solution while a slow flow of air is maintained. Or if the plates may be removed, soaking an hour or two in 33% hyrochloric acid will remove iron deposits from both surfaces and pores.

Air pressure is usually furnished by a blower or condenser of one of the standard makes. Air from condensers is apt to contain small amounts of oil, which chokes up the porous plates and should be removed by filtering the air before it reaches the plates.

London, Ontario, tried 1¼" metal pipes with ⅛" perforations at ½" intervals longitudinally, which gave satisfactory diffusion, but when the air pressure was removed, sewage and sludge flowed into and choked the air system.

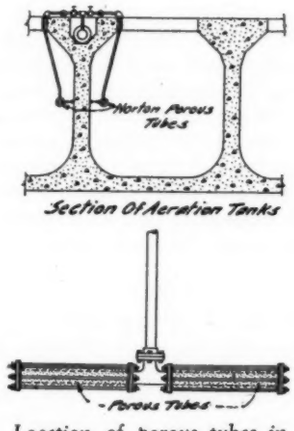


Close-up of Aloxite porous plate.

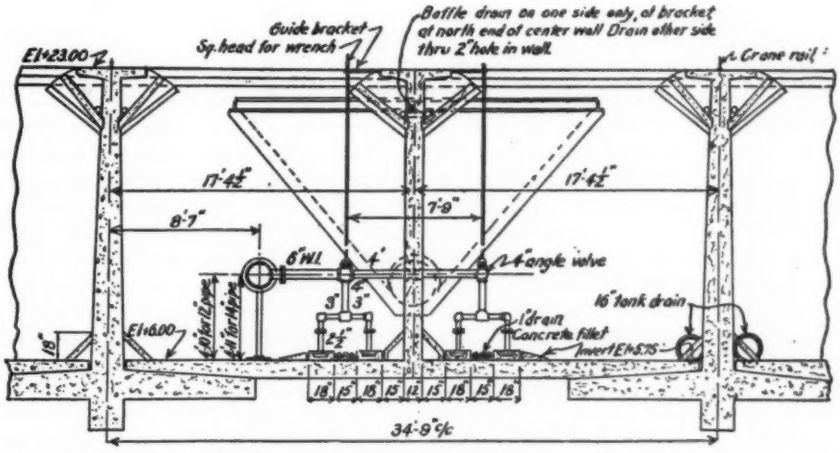
Mechanical Aerators—The Link Belt mechanical aerator consists of straight or spiral ribbons attached to a revolving shaft mounted on one side of a rectangular tank at the surface of the sewage. The revolving ribbon agitates the surface of the sewage, causing it to absorb air, and also draws sewage up through a vertical channel formed by a baffle parallel to and about 18" from the side wall, thus causing a spiral motion of the sewage through the tank. The center of the shaft that carries the paddle blades is located a few inches above the surface of the liquid and approximately 3 ft. from the side of the tank. The paddle-like element has an out-to-out diameter of about 26 inches. At the Collingswood, N. J., plant, where each agitator is driven by a 10 h. p. motor through speed-reducing gear, these areators used 10 kw. h. of current per million gallons of sewage.

Another type of aerator, originating in England in 1915 but not used in this country until a few years ago, is the "Simplex." This consists of a steel cone fitted with vanes which revolves in a horizontal plane at the top of a vertical submerged uptake tube. The revolving cone throws sewage (which rises to it in the uptake tube from the bottom of the tank) in a film which strikes the surface of the sewage in the tank at an angle to the radius, thus agitating the surface and causing the sewage to revolve both horizontally as well as vertically. It is said that the power required to operate is approximately 17 to 20 k.w.h. per million gallons. A plant at Woodstock, Ill., using five units for treating 740,000 gal. per day, average 18.7 h.p. per million gallons for the aerators, and 23.7 h.p. for the total plant, with an aeration period of 6.13 hours; giving a 5-day B.O.D. reduction of 96.3% and suspended solids reduction of 92.3%.

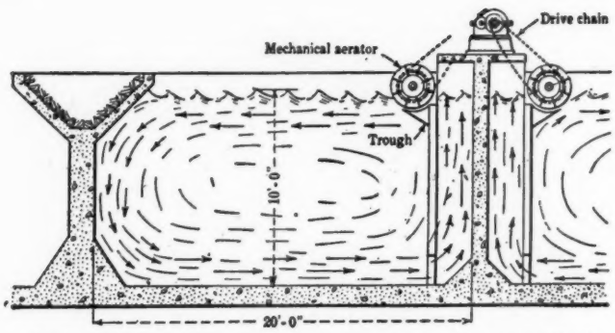
An aerator of the combined mechanical and diffused air type has recently been put on the market by the Dorr Co. under the name of Dorrco Aerator. Air is introduced into the sewage at one side of the tank near the bottom, and a set of paddle wheels revolve, immersed in the sewage, causing a rotary motion of the sewage counter to the upward flow induced by the rising air, thus effecting more complete mixing of air and sewage and longer contact period. At night, while weak sewage is being delivered, the air supply may be cut off, the rotating paddles mixing what solids there



Location of porous tubes in tank, and method of constructing a standard unit.



Cross section of aeration tank for spiral flow, North Side Works, Chicago, showing location of Filtros plates.



Link Belt mechanical aerator in Chicago Sanitary District plant.

are with the previously-activated sludge. A number of paddle wheel units are attached at regular intervals to a shaft which passes axially through the tank, the outer edges of the paddle blades just clearing the semi-circular bottom of the tank and the water surface. There may be one or more shafts in a tank, the most economical construction being two shafts and sets of paddles, so set that the two sets of paddles just clear each other, while the diffused air is admitted through a single row of porous plates placed on the ridge formed by the intersection of the two circular bottoms. Such a duplex installation at Phoenix, Ariz., consisting of six tanks, each 26′ 8″ wide, 15′ deep, and 330′ long, designed for 12 m.g.d., on a 31-day test consumed 0.375 cu. ft. of air per gallon of sewage, air pressure 5 lbs. per sq. in., with an air compressor power consumption of 12.1 h.p. per million gallons of sewage. The power for revolving the paddles was 9.9 h.p. per m.g.; both power rates being based on the actual sewage flow, which was 72% of the design rate. This tank treatment reduced suspended solids 91% and 5-day B.O.D. 90.5%.

Tanks—Most aeration tanks are constructed of concrete, and, as with other sewage tanks, the smoother the walls the less liable they are to retain grease and scum. London, Ontario, found vitrified liner plates at the sewage line to be advantageous, although it was doubtful if the extra expense of construction was warranted. The plates were laid in a line 9″ wide, half above and half below the surface of the sewage.

Tanks for diffused air treatment are generally made 10 to 15 feet deep and with a capacity giving 4 to 8 hours' detention. Where mechanical aerators are used it seems desirable to increase the capacity 50%, more or less. Where preliminary sedimentation is furnished, relieving the aerating process of part of its work, the time may be shortened somewhat.

Removing Suspended Matter

As just stated, it is advantageous to remove part of the suspended matter before subjecting the sewage to the relatively expensive activated sludge treatment. It is now standard practice to pass the sewage through preliminary sedimentation tanks, where the more readily settleable solids are retained.

After aeration, the sewage must be passed through final sedimentation tanks (sedimentation in the aeration tanks must be prevented). The sludge should be removed as soon as possible, both for mixing with incoming sewage and for final disposal. For this purpose, mechanically cleaned tanks are used almost universally in this country for final sedimentation, and generally for preliminary also. Mechanical sludge collectors were described in the September issue.

Disposing of Activated Sludge

Activated sludge is disposed of by digestion in tanks, by manufacture into fertilizer, and by other methods. These will be discussed in later chapters of this series of articles.

Killing Weeds and Some Chemicals for Doing It

The fall months are good times for killing weeds along highways and streets, reservoirs, and other places. Often, even though some of the plants receive insufficient dosage of chemical to kill them, they are sufficiently weakened so that they will not survive the winter. Ira L. Hewitt, county engineer, Burke, S. D., reports that he used calcium chloride last year for the destruction of creeping jinney and Canadian thistle. The Minnesota Agricultural Experiment Station has been doing some work with ammonium sulfocyanate. This chemical has the property of killing all vegetation when applied, but of being converted into fertilizer within a short time thereafter. For instance, when applied at the rate of 15 to 25 pounds per 1,000 square feet, it kills all vegetation, but within two to three months after the application, the ammonium sulfocyanate has been converted into ammonium sulfate, which is one of the best sources of nitrogen for plants, and thus becomes a fertilizing agent. This chemical also keeps the leaves of the plants moist until it is leached off by rain, and has a repellent taste, not liked by cattle, but is not as poisonous to livestock as chlorates.

Sodium chlorate has been used for weed killing, but dries immediately and is inflammable. Atlacide, which is put out by a prominent chemical company, is a chlorate compound having many advantages in weed killing, being easy to apply and non-poisonous to stock. Though temporarily rendering land sterile, it does not do so permanently, and it does not produce a fire hazard.

A weed spray chart is available, which lists most of the common weeds, tells when to treat, and the dosage necessary. We will also be glad to give further details on application methods.

Signing Roads in New Mexico

The first job is locating spots that need signs, which is done generally according to speedometer readings. This record is turned over to the sign crew, and after the signs are erected is returned to the office for permanent record. Caution and warning signs are placed in general accordance with usual practice. Route markers are placed every two miles. Directional signs are placed at intersections and at the edges of towns, using the progressive system.

Signs are usually made of metal with embossed or raised letters, but some wooden or painted metal signs are used. Steel posts are replacing wood posts as rapidly as the latter fail. Cost data of a sign erection crew, which consists of two men operating a truck with a special body, for a 6-month period, show a cost per sign of $3.31. There were 1010 complete sign erections and 1234 replacements, a total of 2244 signs.

THE EDITOR'S PAGE

RFC Funds—An Unusual Opportunity

Letters and messages coming into this office, to some extent in response to our editorial expression of last month, tend to confirm our impression (which we hope may be incorrect) that RFC funds will be handled with such strictness that cities can hope for very little assistance. The many hedges that are being imposed appear effectively to bar the average—indeed, any but the very unusual—community from any hope of participation.

It is proper and necessary that RFC funds be loaned only under definite conditions strictly and impartially imposed. But these conditions should be *wise* and *reasonable*.

Wise conditions imposed on the engineering and financial bases of the public works which it aids would be such that, while not unduly restricting necessary construction, they would give a marked impetus to the best practices in financing, accounting, designing and operating. A sound basis for both construction and operation is necessary from the financial viewpoint. Equally necessary is designing based on use of the most modern equipment and materials, and the latest proved (and improved) technic and methods. In this respect the RFC has an unusual opportunity for raising the standards of public work throughout the country.

Reasonable conditions would be such as will not confine the aid to those cities (or other political units) which could readily obtain it elsewhere; or to large cities or projects, which would limit the benefit to a small number of localities, as seems to be the case now, if we are correctly informed.

Our suggestion to local officials is this: As soon as possible get an expression of opinion from responsible RFC officials as to the basis upon which your proposition will be considered. If you do not feel that your community is being treated fairly, in accordance with the spirit of the relief act, now is the time to "start something." This magazine will do what it can. Do not be afraid to ask for help.

Are Your Public Works Being Starved?

We do not believe that the conditions in this country as of to-day are either normal or likely to remain for long as they now are. That is something for many of our public officials to consider and to remember. They should think back over the past two or three years and remember the lack of maintenance they have accorded to the roads or streets of their community; remember the deficiencies in their water works system revealed by the past three years of dry weather; remember the sewer extensions needed; remember the new streets and highways waiting to be paved so that they may serve an impatient population.

We are no believers in useless public works, or any other kinds of works constructed merely to relieve unemployment; but we do believe that right now is the time to begin to catch up on the needed, permanent, and self-supporting public works such as those listed above; especially as this need is augumented by that for unemployment relief. Credit is presumably available to almost every municipality. Employment is needed. The needed projects are waiting. Construction prices are very low. What further inducement can any progressive or intelligent official crave?

The taxes which seem so high now will recede into comparative unimportance as the present depression passes. It is a costly mistake to attempt to subsist now solely upon the physical assets built up in the past, and to allow them to depreciate because of lack of attention. A reasonable construction program is a necessity, and the public official who is progressive enough and courageous enough to go ahead now, taking care of the improvements of his community and solving the unemployment problem, will establish himself more than ever in the permanent esteem and standing of his community.

Use the Budget-Cutting Ax With Discretion

"Where" says the citizen, "does my tax money go, and what do I get for it? In return for my $450 of taxes, my children have a school to go to, and I see a policeman now and then. Thank the Lord, I've never had to call on the fire department, but I guess they are OK. But I pay for water, so I guess the water department is self-supporting, and I've paid for street and sewer and curb by assessment. Where does all the money go?"

That is a question that a good many citizens and taxpayers are asking, and we suspect the reason they are asking it is because they really do not know and cannot guess. Some consideration and investigation, however, would probably show that much of the tax money is spent unwisely, although perfectly legitimately, and that most city and state appropriations could and should be cut—some of them drastically.

Cutting of budgets, however, should not be made indiscriminately all along the line. In fact, probably some items should be increased at the expense of others. Streets and roads—at least the city or county official might provide and maintain smooth and travelable streets and highways—something that the taxpayer can appreciate and see and use. He might eliminate the unsightly and odoriferous sewage plant that dates back to the well-known mauve decade, and that is a constant source of complaint and a likewise constant threat of damage suits. He might try the same idea in garbage collection and disposal. And he might take a chance at improving the quality or palatability of the water supply, (which wouldn't increase taxes because that is self-supporting anyway).

Within the next few months, many budgets will be made up to a chorus of wailing and weeping and gnashing of teeth on the part of the taxpayer. But if the money is spent so that the taxpayer will be able to see how it has helped him, the wailing, etc., is more than likely to change to applause. Many budgets can be cut to advantage but the cutting should not be applied to the essential services that have to do with the comfort, welfare and health of the people.

In Iowa, bulk cement is unloaded and batched by hand for 5c. per barrel. It is hauled in contact with the aggregates, but is covered with sand so it will not blow away.

Practical Details of Concrete Construction

By William E. Barker
Highway Engineer, Portland Cement Association

IV—Batching Aggregates

MUCH of the remarkable improvement in concrete quality of the last decade is due to the accurate measurement of materials. Beginning by counting shovel-fulls of sand, stone and cement, and pail-fulls of water (if the water was measured at all), measuring methods have progressed to batching by weight, which does not condone errors exceeding five pounds for any of the materials in a truck load of concrete.

The chief benefit of this greater accuracy has been increased uniformity in strength and durability. Formerly, variations were great and designers dared not assume anywhere near average strengths, lest a weak batch cause failure of the entire structure. Accurate control of each batch, combined with higher-strength cements, has doubled allowable working stresses without increasing cement content. The result is thinner floor slabs, smaller columns and beams or longer spans, due to both higher stresses and reduced dead load.

Measurement by Volume

Modern measurement of aggregate by volume is accomplished in hoppers hung beneath aggregate bins. These hoppers are adjustable, so the volume can be changed, and are set close under the charging chute, so that the flow of materials stops automatically when the hopper is full. They are as accurate as any practicable volume measure can be.

As explained in the September issue, one cubic foot of dry, compacted sand may become as much as 1.4 cu. ft. when damp and loose, the bulking varying with moisture content and fineness of sand particles. Unless it is determined and corrected for whenever important variations occur, reasonably accurate volume measurement of sand is impossible. Coarse aggregate is affected little by moisture, and can be measured by volume with sufficient accuracy.

The simplest method of determining amount of bulking is to fill a watertight measure with sand from the storage pile or bin, letting it fall into the measure about as sand will fall into the measuring hopper. Then inundate the sand, stir it to eliminate air, and measure its loss in volume. The damp, loose volume divided by the inundated volume gives the factor by which the volume measured must exceed the dry volume required.

Because inundation eliminates bulking, apparatus has been devised for inundating the sand for each batch. The measuring hopper is first filled with water and then with sand, the excess water spilling out. This method has one serious disadvantage: for the drier mixes, like those used in paving and larger structural members, more water is required to inundate the sand than is needed in the concrete.

Cement should never be measured by volume, for a cubic foot of loose, fluffy cement may contain only three-fourths as much actual material as a cubic foot of normal, compacted cement. Sacked cement is weighed at the mill. A sack contains 94 pounds or approximately 1 cubic foot of cement.

Batching by Weight

Measurement of batches by weight eliminates all need of correction for bulking and is so much more sensitive than measurement by volume that greater, most consistent accuracy is inevitable.

The measuring hopper is hung on the levers of a beam or dial scale. There may be a hopper and separate scale for each material or they be measured in one hopper with, in the case of the beam scale, a separate beam and poise for each aggregate. Cement is usually weighed in a separate hopper and on a separate scale.

The weighing hopper and the scale itself must be protected from the wind. The hoppers, especially the one in which cement is weighed, require frequent inspection to detect material encrusted on the sides. Dust should not be allowed to accumulate on the scale levers.

After each new plant set-up, the scales are calibrated. A set of standard weights is hung on the hopper and the scale reading is noted. Since only a small portion of the capacity of the scale can be represented by weights, the weights are then removed and sand run into the hopper until the scale is in balance. The standard weights are again hung on the hopper and the new scale reading is noted and this operation is repeated until the scale is checked throughout its entire weight range. If the scale is found to be in error, but not sufficiently so to cause it to be discarded, a chart is made up showing weights read on the scale and corresponding true weights, and each weight set off on the scale beam is corrected accordingly. The scale is frequently balanced at zero load, and occasionally the standard weights are used to check the reading for that one weight.

Cement may be batched either from an overhead bin with a weighing hopper beneath, or by hand. If from a bin, a small air jet is provided that can be turned into the chute leading to the hopper should it become blocked.

Hand batching is the popular method. Two-wheeled concrete buggies are run into the cement car, filled by men wielding scoop shovels, weighed on a platform scale and dumped into the truck, industrial railway car, or mixer.

The accurate measurement of water is next in importance to that of cement. For the stationary mixer the problem is simple, for the measuring tank can always be set level. For the paver, which stands on a crowned subgrade and travels up and down hills, the only accurate measuring tank is an adjustable closed chamber which is completely filled and emptied for each batch, or an accurate meter that shuts off the supply when the correct amount has passed. The common 3-way valve is a source of error, for it may leak and by-pass unmeasured water into the drum.

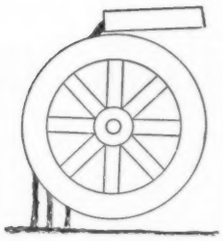
The actual amount of water going into the drum should be checked occasionally. That can be done conveniently by attaching a hose (an old inner tube makes a good one) to the end of the water pipe in the drum, so the water will discharge directly into cans, where it can be measured or weighed.

Water on the surface of the aggregate must be included as part of the mixing water. It may be determined by immersion, as with the pyconometer and the Dunnegan apparatus, or by weighing, surface drying and reweighing a sample of aggregate. If the latter method is used, air drying is simplest. The damp aggregate is weighed, spread on a canvas in the sun, and when its looks and feel indicate that surface moisture has just disappeared is again weighed, the difference being the weight of surface moisture.

The batch weights given the scaleman include the water in the aggregate and this must therefore be added to the dry weight in calculating the weights to be set off on the scale.

Moisture in aggregates brought from a washing plant may vary so widely that stock piling for sufficient time to permit drainage is necessary to secure uniform water content.

THE WATER WHEEL



FOLLOWING are the essential features of the important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted. Published every month to include articles appearing during the preceding month.

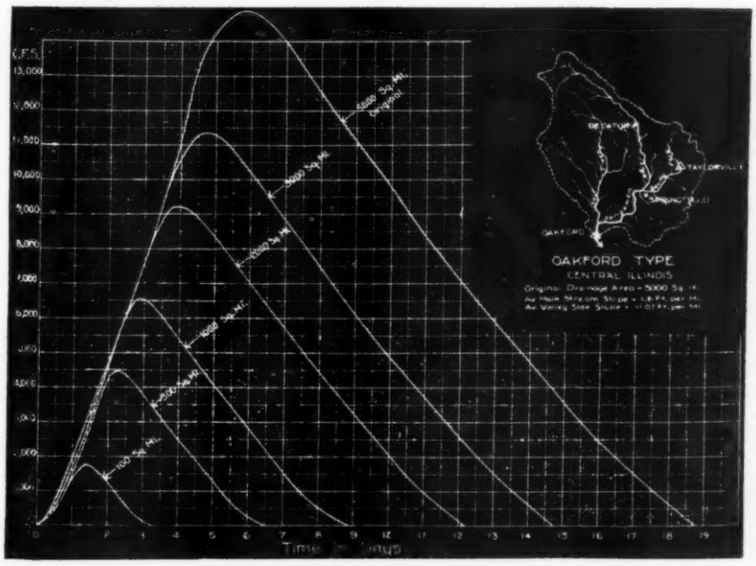
STUDIES of surface and underground yield and related phenomena comprise twenty percent of the articles listed this month, chiefly because of the papers in the report of the thirteenth annual meeting of the American Geophysical Union, Section of Hydrology. These papers are of a highly technical nature, and most of the authors are connected with the U. S. Geological Survey and federal and state departments and commissions having to deal with river regulation, agriculture, water power, and other phases and applications of hydrology.

Surface Runoff.—In northern states melting snow adds considerably to the runoff in the spring and the amount of this is determinable. "As contrasted with rain gauge and snow board measurements, snow surveying is an infant but rapidly growing method of forecasting seasonal water supply," says J. E. Church[30]. "It has now become a part of the organized state service in Nevada, Utah, Oregon, and California. . . . In New York, the snow survey established in the Black River Regulating District has become a large cooperative effort covering the Adirondacks." The methods developed by Mr. Church for Nevada have been adopted, with modifications, for the Adirondack Survey[31]. "Because of the uniformity of depth and the low density of snow in this region, the 3-inch snow tube was selected in place of the 1½-inch tube found most satisfactory in Nevada." Last summer the U. S. Geological Survey, State Dept. of Public Works, Black River and Hudson River Regulating Districts, Utica Gas & Electric Co., New York Power & Light Co. and Associated Gas & Electric Co. agreed to conduct a joint snow survey over the entire region last winter, but failed to carry out their program because of one little oversight—to provide the snow. Last winter no snow accumulated to be measured.

A "unit graph" is defined by L. K. Sherman[39] as "the hydrograph of runoff from a given area, due to a one-inch runoff depth applied in one day or in any other convenient unit of time. . . . After the unit graph has been derived, a runoff record for the given area, for any rain or series of rains, may be computed by a simple summation process." "After the graph has been determined for the original area, then the unit graph for any other similar basin, regardless of size, may be quickly found." How to do so is the purpose of Mr. Sherman's paper. The illustration reproduced shows a unit graph for areas of from 100 to 3000 sq. mi. similar in physical character to the Oakford basin.

"One of the central problems of hydrology" says Robert E. Horton[40] "is the correlation of the hydrologic characteristics of a drainage basin with its morphology, soils, and vegetation." This correlation he endeavors to embody in a number of formulas.

The conclusion of Messrs. Hoyt and Troxell, quoted in the Water Wheel last month, that "scientifically determined facts apparently do not warrant the development of forests solely for the conservation of water supply" is emphatically criticized by C. G. Bates, of the U. S. Forest service[29], who says that the water sheds upon which the conclusions were based are extreme in character of soil and climate, that the authors "omitted many facts that are vital to any logical and sane discussion" of this subject. He marshals facts and arguments in support of his opinion that prevention of erosion is vitally important, and that in most localities forests are essential for this purpose if for no other.



Unit graphs for 100 to 5,000 square miles for a runoff area of the Oakford type—flat country in central Illinois.

Underground Water.—An investigation of the ground water resources of Texas was begun in September 1929 by the U. S. Geological Survey in cooperation with the State Board of Water engineers, and is being continued, employing the full or part time of 12 geologists and engineers; the State Board of Health assisting by making sanitary studies of the ground water. Funds for the work are contributed in equal

amounts by the Federal government and the State[58]. "In Dimmit and Zavala counties, approximately 27,000 acres are irrigated from wells in the Carrizo sandstone, but the area of artesian flow, originally large, has almost disappeared, and in many wells the water level declined 30 to 60 feet during the last few years. . . . The safe yield of each underground reservoir is a definite quantity and if this safe yield is exceeded serious difficulties are sure to follow. A law is needed in Texas similar to the ground-water law recently put into force in New Mexico, which awards ground water rights comparable with surface-water rights and provides that new ground-water developments can be prohibited where the supply is already fully utilized."

Another investigation of ground waters made by the U. S. Geological Survey in Escalante Valley, Utah, formed the basis of a method of estimating such supplies based on discharge by plants and evaporation from soil[99]. Walter N. White, who carried out the experiments, says: "In some localities the ground-water level has been observed to decline during the day and to rise at night, the decline beginning at about the same hour every morning and the rise at about the same hour every night. This daily decline is due to the withdrawal of ground water from the zone of saturation by plants, and the rise at night is due to upward movement of water under slight artesian pressure from permeable beds of sand and gravel at some depth beneath the water table." Using this as a basis, the amount of ground water discharged in producing a unit weight of dry vegetable matter was computed for each of a number of different kinds of plants; allowance being made for evaporation from the soil, rain, barometric pressure and other factors. In land covered with meadow grass, for example, daily fluctuations of 2¼ to 4¼ inches were observed; sage brush apparently uses little or no ground water.

Corrosion of metals by water or other liquids, as in water pipe, boilers, etc., is an important consideration in treatment of water and in selection of materials. A rapid method of determining the presence and rate of such corrosion is described by the president of the Am. Soc. of Testing Materials[71], consisting of examination, under the microscope at about 50 magnifications, of specimens that had been polished and exposed to the liquid for a day or less. The test checked with the result of two years' actual use.

The U. S. Bureau of Standards has determined, it is reported[50], that corrosion of pipes under ground is not caused by electric currents leaving the pipe, but that the flow of currents is caused by the corrosion, and that coating with a suitable bituminous substance will prevent corrosion if and so long as the coating contains no pin holes or other breaks in perfect continuity.

Corrosion of well screens can be remedied by the use of muriatic acid; or, where the soil is high in organic and clayey material, with this followed by sulphuric acid, according to H. O. Williams[92]; the acid being allowed to stand in the screen for eight hours or so, with stirring at intervals. Detailed instructions are given in the article.

Water Waste, which exists to some extent in every system, is a subject concerning which it may be asked what causes it, should it be reduced, and how. Descriptions of how it is reduced in three communities in three different ways are given in this month's literature[76, 79, 81]. In Reading, Pa., a continuous leakage survey is made, chiefly by two leak patrolmen who cover the 160 miles of pipe every three weeks. Using a metal rod and an earphone, the rod is placed in contact with each gate valve (all of which are housed in vaults) and each fire hydrant stem. Leaks have been heard in a ½-inch service a city block away. Unaccounted-for water has been reduced from 8.86 m.g.d. to 2.82 in six years. The cost of the six years of survey has been $52,169; the value of the water saved, $1,881,525.

The New Rochelle Water Co. has developed a Pitometer crew, consisting of two men and two laborers, equipped with two Cole pitometers, one indicating and one recording, the necessary calipers, etc., two portable pitometer shelter houses and a half-ton truck. This crew is not continuously on this work, but only when the minimum night flow shows an unaccountable increase. Service leaks are discovered by the meter readers who, as a matter of routine, test all services with an aquaphone when they read the meters. During the last three years 144 leaks in mains and 435 in services have been discovered and repaired and unaccounted-for water reduced from 35.9% to 20.8%.

Bluefield, Va., uses service meters for cutting down waste other than leaks in mains; apparently the latter have not yet received attention.

Quality and purification of water, as usual, formed the basis of more articles than any other one subject—26 items in all. R. E. Tarbett, sanitary engineer with the U. S. Public Health Service, reports[15] that in 1931, 1944 public water supplies in the United States were used as sources of drinking and culinary water by interstate carriers and that 79% of these were recommended favorably as complying with the Treasury Department Standard, 18.5% given provisional certification and 2.5% prohibited for use. Of those provisionally certified, 78% met the bacteriological standards; indicating presumably that at least 75% of all the public supplies of the country meet this standard as a whole, and 90% the bacteriological standard.

Such a standard is very valuable, but does not tell the whole story. The New England Water Works Ass'n adopted a tentative scoring method by which public water supplies may be rated numerically and compared. Said Mr. Chase[16]: "A single criterion of quality based on analytical methods may fail to give even a reasonably true picture of the relative public health hazards of different water supplies." Cross connections with polluted supplies, for example, may be an important hazard factor. It is hoped that this scoring method, or some modification of it, may be generally adopted (as by all state health boards) so that the shortcomings of every supply may be known and remedied.

Bibliography of Recent Water Works Literature

c indicates construction article: *n*, note or short article; *t*, technical article.

Am. City, September.

1. Surface and Subsurface Waters and Vegetation. John C. Hoyt, U. S. Geological Survey, p. 7.
2. Babson Reservoir Built in Six Months. E. B. Myott, pp. 49-53.
3. The Strictly Modern Pumping and Filtration Plant at Niagara Falls, Ontario. H. G. Acres and S. W. Andrews, pp. 57-61.

Canadian Engineer, August 23.

4. New Deep-Well Water Supply for the City of London, Ont. V. A. McKillop, pp. 11-14.
5. Water Purification Plant at the Schubert Swimming Bath, Montreal. G. D. O'Connor, pp. 17-18.

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6. New Pumping Station and Water Purification Plant at Granby, Que. G. D. O'Connor, pp. 15-16.

Engineering News-Record, August 25.

7. Three Dams on San Andreas Fault Have Resisted Earthquakes, pp. 218-219.
8. Water Commission Advises Against Sprinkling Ban in Minneapolis, p. 222.

September 1

9. 200-Year-Old Masonry Dams in Use in Mexico. Julian Hinds, pp. 251-253.

September 15

10. Notes on Abutment Sluicing at St. Gabriel Dam No. 2. E. C. Eaton, pp. 311. (*Continued on page 38*)

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Highways and Pavements

Powdered Asphalt in Highway Construction

By B. C. Samples
County Engineer, Boonville, Ind.

POWDERED asphalt is manufactured by the Ohio Oil Co., and is called Lincoln-ite. It is an extra dry concentrated asphalt, from which all oil and moisture have been extracted by high temperatures under vacuum. This material is finely divided, has a high melting point and a negative penetration.

In Warrick County we have used powdered asphalt to quite an extent, but only in conjunction with road oil of high asphaltic content to produce an oil mat on an old gravel or macadam base. The principal steps in developing the mat are:

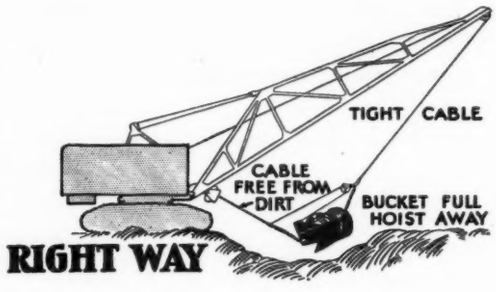
1. Choose a road with a good stone or gravel base.
2. Spread clean river gravel upon the base about two or three inches deep, depending upon the depth of the desired oil mat.
3. Maintain for a short time under traffic, and then windrow at the sides of the road.
4. Examine the condition of the base with the "pot holes" filled by the loose gravel and determine the rate at which the first application of road oil shall be made. Usually this will be .40 to .70 gallon per square yard of surface; allow this application to penetrate the loose gravel in the pot holes and the base for a short time, depending upon the existing temperature.
5. Blade the gravel from the windrows across the surface in sufficient quantities to absorb all the road oil; using maintainers and graders to distribute the particles of gravel to the desired cross section, and to mix the oil and aggregate thoroughly.
6. With these steps completed it may be necessary to place a second application of the hot road oil. This application is usually very light, the amount varying with the grade of the aggregate and the riding quality desired upon the oil mat. We have used from .30 to as high as .60 gallon for this application. In case this application is deemed necessary then step No. 5 may be repeated, until a uniform color or mixture of the gravel and aggregate is noted and proper cross section obtained.
7. After a period of twenty (20) to thirty (30) hours has elapsed, the powdered asphalt is spread upon the surface with a lime spreader or other improved mechanical device at the rate of three-fourths (¾) to one (1) pound of the material to the square yard of surface, dragged lightly and opened to traffic.

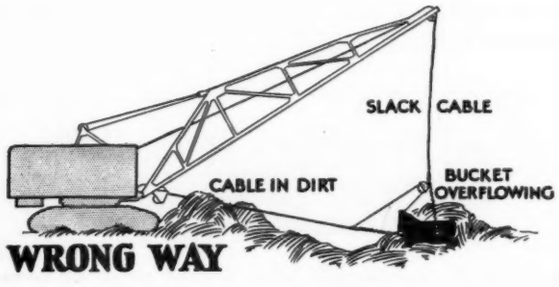
This is the process which we have used. The results have been that we were able to construct a tough, durable and impervious oil mat at an exceedingly low cost per mile. We could also use local labor and material to a great advantage. The powdered asphalt minimizes the "bleeding" to the surface and greatly reduces the "pickup" of the gravel and oil mix. One particularly interesting thing occurred this season. The traffic from Indiana State Route No. 62 was routed over one of the County Highways upon which we had twelve hours before completed the oil mat as described. This traffic was very heavy truck traffic, consisting of about six times the normal traffic which we had designed the oil mat to carry. The mat has withstood the heavy traffic now for several weeks, and except upon sharp curves has held up exceptionally well.

Dirt Moving Helps and Hints

By D. B. Patterson
Vice President, Harnischfeger Corp.

THE operating cycle of a shovel can be divided into four consecutive actions: 1. Loading the dipper; 2. Swinging over the hauling unit; 3. Dumping the spoil; 4. Swinging back into digging





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position. Moving forward may be classed as a necessary interruption.

In ordinary excavation, four or more feet in depth, a one-yard shovel should make at least two complete cycles per minute—providing hauling devices, such as trucks, are so placed that the average swing does not exceed 90 degrees (a quarter swing).

The respective time allowances per cycle are: Filling the dipper 12 seconds, swinging to and spotting over truck 9 seconds, dumping 2 seconds, returning to digging position 7 seconds. The following hints may help to maintain this schedule:

Filling Dipper: Keep the dipper teeth sharp. Move forward frequently. Clean up the floor, permitting dirt to slide down into a loose heap.

Swinging and Spotting: Hoist while swinging. Keep the hauling equipment close to cut, thus avoiding a long swing. The difference in swinging 90 degrees compared with 180 degrees may cut the output 25%. Do not swing too fast when approaching the wagon.

Dumping Spoil: When the dipper is nearing tripping position, take up the slack in the trip rope. Start swinging back as soon as the trip is released.

Swinging Back to Dig: Start lowering dipper, and reverse the crowd, being ready to crowd forward when the dipper strikes the ground.

A fast operator is not the only essential for fast loading. He can only dig what the equipment can haul. If the wagons or trucks are inadequate, or if they are poorly managed, maximum output cannot be expected.

Dragline Operation

With the help of Frank R. Kuhn, contractor of Winamac, Indiana, we are passing along some dirt moving hints which point to more economical dragline operation. Mr. Kuhn is an old time, experienced operator and a very successful excavating contractor.

When starting a cut with a dragline, begin close to the machine. By so doing much time can be saved over the method of casting the bucket to the maximum distance at the very beginning. Move the dirt which lies close to the machine first. The more distant dirt will have a tendency to follow into the cut. When the bucket is full, hoist out and get rid of it. Much time and power is wasted when the bucket is pulled along after it is full.

When the dirt is kept cleaned away from the front of the machine, the cable does not bury itself when the bucket is hauled in. This not only lengthens the life of the cable, but also enables the operator to cut a smoother, more accurate slope. Furthermore, greater depth can be attained close up to the machine.

Hoist and drag cables should be kept tight. When the bucket is cast with the drag cable slack, it may land upside down, backward, side way or most any other way. This practice not only causes kinking and breaking of the cable, but also results in lost time.

When the hoist cable is kept taut the bucket can be hoisted the moment it is full. If slack is permitted in the drag cable while the bucket is being hoisted, much of the load spills out.

Paying for Dust Control

Some communities spread calcium chloride on streets to prevent dust, paying for it out of the regular highway budget as they do for sprinkling or cleaning pavements. Other communities apply the dustlayer on petition of residents, charging a definite sum per foot as applied.

Transporting Concrete in Rotating Drum Increases Strength

Tests have been made at Fritz Engineering Laboratory of Lehigh University to determine the relation between the strength of a concrete and the time of retention in the drum of a conveyor, and whether a drum without blades would maintain the homogeneity of the concrete during transportation in at least as good condition as that in which it was received from the mixer. Concrete was transported for periods varying from a few minutes to 2½ hours in a conveyor made by the Clinton Motors Corporation, consisting of a cylindrical drum of 2 cu. yds. rated capacity, smooth on the interior, rotated at about 8 r. p. m. independently of the motion of the truck carrying it. When closed after receiving a charge the drum was tight except for a slight leakage of water estimated at 1/3 of one per cent of that contained.

Two cements were used, one taking an initial set in 178 minutes and final set in 337 minutes, the other in 140 and 322 minutes respectively; but these differences had no effect on the results which could be observed or measured.

A summary of the results, as reported by Prof. Willis A. Slater, director of the laboratory, is as follows:

The slump was generally about 8 in. as the concrete came from the mixer, but decreased very consistently during the time of retention in the conveyor drum. Even after 2½ hours in the conveyor, the consistency was such that the concrete could have been used quite satisfactorily for road or pavement work, where the requirements are especially rigid.

The amount of water and the sum of the absolute volumes of the cement and aggregates remained practically constant throughout each run. The amount of cement, however, appeared to increase. As this apparent increase was about the same as the decrease in the absolute volume of the sand, it is likely that it was due to the pulverizing of the aggregates, especially the sand.

The apparent increase in cement content in a batch of concrete mixed in a Jaeger mixer for 1 hour 15 minutes was much greater than that in the drum of the conveyor and the stiffening of the batch was correspondingly more marked.

There was no indication of segregation of the concrete in the conveyor drum as observed visually, or as determined by testing the composition of the concrete.

The strength of the concrete from samples taken at successive intervals after charging the conveyor drum increased progressively according to the length of time of transportation.

Convention of Am. Soc. of Municipal Engineers Postponed

The convention of the Am. Soc. of Municipal Engineers, which had been scheduled for November 7 to 11 at New Orleans, has been postponed to January 16 to 19 and transferred to Detroit.

The change of location was decided upon because it was felt desirable to reduce the expenditure of members attending the convention for fares (or gasoline), and New Orleans is so far from the center of membership of the society that it was feared the attendance there in this year of municipal enconomizing would be limited.

Detroit and the date chosen offered the advantage of joining in the combined Highway and Building Congress, to be held in Detroit January 16 to 20. Twelve associations already have decided to join the group. Each will hold its individual meeting the first three days. Thursday there will be joint sessions devoted to highways, and Friday will be devoted to building and general construction.

Responsibility for Dead Animals in Highways

At the request of a health commissioner, the director of health of Ohio submitted to the attorney general a request for an opinion as to whose duty it is to cause the proper disposal of carcasses of dead animals found in public highways. The attorney general has advised that a local board of health is without authority to issue an order to the director of highways to abate such a nuisance, and that the responsibility of the director of highways relates only to such duties as affect the public convenience and safety as contra-distinguished from health matters.

As the statutes providing the procedure for the abatement of nuisances require that this shall be done by an order issued to the person responsible for the nuisance, or to the person upon whose property the nuisance is located, the effect of this opinion is to lay the additional burden upon local health commissioners of discovering the owner of the dead animal and requiring action by him to provide for the proper disposal of the carcass.

The statutes further provide that where an order of the board of health for the abatement of a nuisance is not obeyed the board may, after necessary procedures, cause the nuisance to be abated and certify the cost to the county auditor to be assessed against the property on which the nuisance was found.

Boards of health have not been given funds for the abatement of nuisances and it is the obvious intent of the legislature that the property upon which the nuisance is located shall be burdened with the expense of abatement.—*Ohio Health News.*

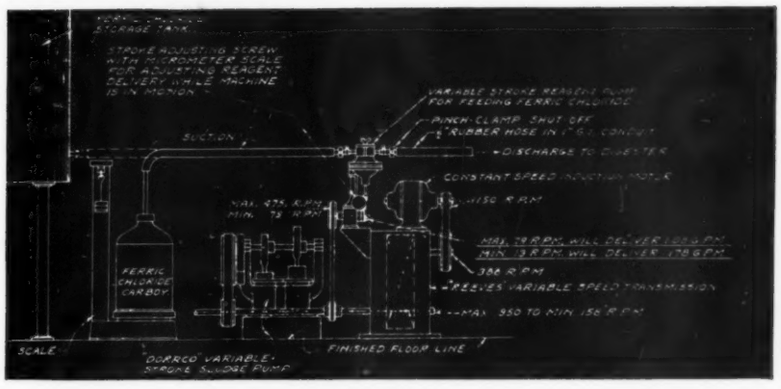
Preventing Erosion on Highway Fills With Straw

The practice of covering the raw, fresh slopes of newly constructed roads with straw to prevent erosion on certain soils and to assist in starting a sod is being used more each year in Indiana. The loose straw is spread on the slopes to a depth of about 8 inches. A very light amount of soil cast over the straw will stop any tendency of the straw to slide down the slope. The work should be done late in the fall so that the fall and winter rains will pack the straw and sprout the seed usually found within. A good growth of vegetation will soon develop. During the winter and spring other seed will be caught in the straw and start growing. In the spring grass seed should be sown to help the volunteer growth. A good sod will usually have been formed by the second summer.

Maintenance of the straw covering is necessary. In some places where the volume of water is heavy, washes will come. These places must be replaced with alternate layers of earth and straw, rip rap or some more permanent type of repair. In a few cases the straw will catch on fire and burn, requiring replacement. Because of this hazard, strawing should not be done during the hot, dry season. The maintenance work on new construction when using straw is very materially reduced. The washes which develop on the unprotected slopes in some soils are very greatly reduced where straw mats are used. By using straw on the large fill slopes, maintenance costs are held down to about the normal cost of roadbed maintenance.

Sanitary Engineering

Water Supply — Sewerage — Refuse Collection and Disposal—Sanitation



Sketch-diagram showing method of mounting ferric chloride control at West Side sewage treatment plant, Chicago.

Automatically Proportioning Ferric Chloride to Sludge

THE Chicago Sanitary District, in their West Side experimental plant, soon to be completed, will use ferric chloride for conditioning the sludge for filtering and drying. The efficacy of this method depends upon the accuracy with which the reagent is proportioned to the changes in the quantity of the sludge, and the ability of the operator to adjust the feed to compensate for variations in the character of the sludge.

A difficulty in the handling of this proportioning problem lies in the corrosive character of ferric chloride, for which no resistant metal or alloy has been developed for commercial use, and the added difficulty in delivering extremely small percentages of the reagent into the sludge, in proper proportion.

Special equipment was built for handling the ferric chloride feeding. This was connected by texrope and pulley drive to the variable speed shaft driving the Dorrco sludge pump. Thus it is kept in step with the rate of flow changes of the sludge. A gear reducer slows down the drive to a practical pumping speed. The reducer unit drives an eccentric and connecting rod which flexes a rubber diaphragm pump at a rate proportionate to the sludge throughput. The diaphragm, casing, special check valves, reagent piping and all other parts which are in contact with the reagent are of rubber, hard or soft. Check valves are made for immediate inspection, removal and cleaning.

The diaphragm is 6 inches in diameter, feeding from 2 gallons a minute down to practically nothing. Its adjustment lies in the arrangement for shortening the stroke, which is accomplished by turning a stroke adjusting screw. A scale is located on the micrometer adjusting screw for indicating the stroke length or reagent delivery. While the machine automatically compensates for sludge flow changes, the operator can, even during high speed operation, adjust for minute changes in the ferric chloride feed to maintain constant pH readings.

The machine for automatically proportioning the flow of ferric chloride was designed and built by Proportioneers, Chicago, Ill.

Electrical Deposition of Asphalt on Pipe

Discussing the article on corrosion of cast-iron water mains which had appeared in the English paper, "The Surveyor" (see *Public Works* for September, page 9), The Eric Engineering Co. of Chepstow, Mon., states that that company uses an "electrical process of deposition of bitumen (asphalt) from an aqueous emulsion. A film of pure bitumen is deposited of thickness unobtainable by many coats of sprayed paint. No solvent is used, and no subsequent drying required, and the coating may be exposed to water directly after deposition without fear of any tainting action. The electrolyte used being aqueous, the presence of large quantities of water is in no way detrimental, as the concentration of the emulsion used may be varied over wide limits.

"Complete control is assured from ground level by the electrical instruments used. Bitumen being an insulator, the deposition, which is very rapid, is continued until a zero reading is obtained on the ammeter, which gives a positive indication that a complete coating has been obtained on the pipe at that point."

Ferric Chloride in Sewage Treatment

(*Continued from page 21*)

However, chemical treatment of sewage cannot be considered a panacea for all the maladies from which a plant may suffer. Careful experimental work is necessary to diagnose and prescribe treatment, and constant control is required, owing to the wide variation in different sewages and sludges. Selection of the method of dosing and mixing, and the time allowed for flocculation, requires careful study and competent advice before definite lines of procedure can be developed. The possible effect on subsequent treatment, and the equipment necessary for handling ferric-chloride, are both important questions.

There is a fast-growing appreciation of chemical and mechanical processes in sewage treatment on the part of many who have been accustomed to thinking in terms of biological treatment alone. A comparison of costs on the basis of annual expenditures for operation and maintenance together with interest and depreciation charges, will warrant investigation of the possibilities in chemical and mechanical treatment as an aid to existing methods. And especially now, when high capital costs are most important, the possibilities of chemical and mechanical methods as the sole process of treatment are sufficiently attractive and promising to invite further trial on a larger scale.

Readers are invited to send to *Public Works* suggestions or inquiries concerning additional uses of ferric-chloride in sewage treatment. Data from tests and service use of chemical precipitants will be furnished on request made either to this office or to Mr. Clark.

Recreational Use of Water Supply Reservoirs

THE extent to which the lakes primarily designed for water supply purposes may be used for recreational purposes must depend upon such factors as the amount of water stored and the efficiency of purification which is provided by treatment works before the water is ultimately used for domestic consumption. In any event, some restriction of use is necessary to prevent excessive pollution of the supply and unnecessary loading of the treatment plant. In a recent issue of Kansas Municipalities is the following discussion of conditions in that state:

The City of Horton receives its water supply from Mission Lake which was created ten years ago for this purpose. The lake covers an area of 177 acres and impounds approximately 700 million gallons of water. The lake is stocked with fish, and fishing and boating are permitted through the purchase of a special city license. Bathing is not permitted, and concessions on the shores of the lake are prohibited. In this instance, the amount of water impounded is sufficient to supply the city for a period of over a year with no rain, and since all of the water used is passed through a filtration plant and sterilized, the degree of pollution through the restricted recreational use of the lake is not excessive. The City of Eldorado places similar restrictions on the use of Lake Eldorado, as do the cities of Herington and Augusta on the use of their large reservoirs.

A question has arisen recently in connection with the use of a small holding reservoir for recreational purposes. In this instance the reservoir is of limited capacity and is used to store water which is pumped from a creek at some distance, as a reserve supply until used. The city has recently beautified the grounds around this reservoir, forming a park which is used extensively for picnics. A number of boats on the small lake make boating a popular pastime, and fishing is also permitted.

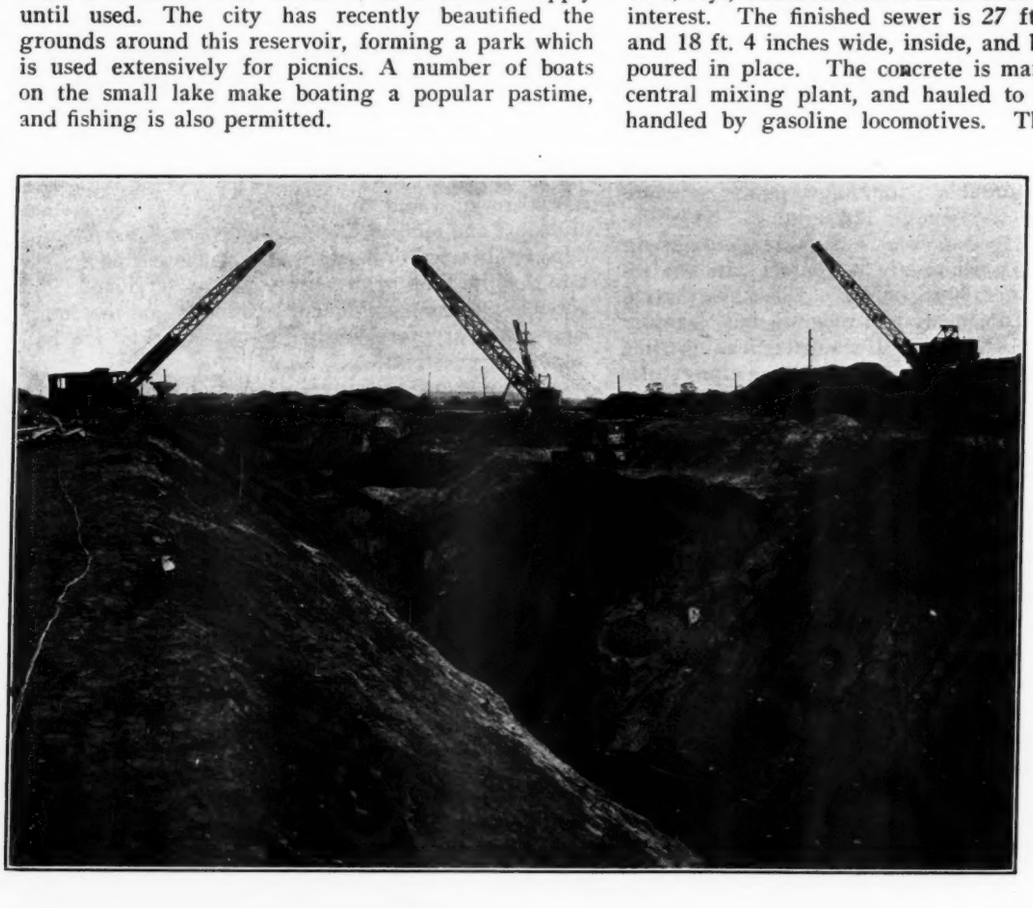
In this particular case, the small reservoir must be considered as a part of the purification works. It is used as a plain settling basin to remove turbidity from the creek water before filtration. The natural purification accomplished in the reservoir is an important factor in relieving the load on the treatment plant and any unnecessary pollution or stirring up of the water materially reduces its efficiency. Extensive use of the shores by picnickers also increases the pollution load, unless the grounds are kept immaculately clean. In regulating recreational use of such grounds for the protection of the public water supply, the following requirements should be included:

1. Bathing in the lake prohibited.
2. Boating carefully limited or, preferably, prohibited.
3. Picnic grounds carefully cleaned and numerous containers provided for the disposal of garbage and trash.
4. Sanitary toilets conveniently located and used exclusively by picnickers.

The presence of a delightful lake is a valuable asset to any community, and it is entirely fitting that such bodies of water be used for recreational purposes. Where the primary purpose of the lake is to provide a source of water supply, however, it is necessary to restrict recreational use to the extent that the water supply will not be endangered and the public health thereby jeopardized.

Constructing Louisville Outfall Sewer

Unusual features of construction, as well as the size of the project, make the building of the Louisville, Ky., Southwestern Outfall sewer a job of much interest. The finished sewer is 27 ft. 6 inches high and 18 ft. 4 inches wide, inside, and built of concrete poured in place. The concrete is manufactured in a central mixing plant, and hauled to the job in cars handled by gasoline locomotives. These cars dump



Constructing the Louisville Outfall Sewer. At this point a cut of 65 feet was required.

into pouring spouts, when the concrete is handled by a short inclined belt conveyor, which carries it to the center of the sewer line at an elevation high enough so that it flows by gravity to the top of the arch forms. For the inverts, the concrete is placed direct by chutes.

The illustration shows some of the recent excavation work. At this point the excavation is 65 feet deep. Back-filling is being done by means of a large followboard, which is pulled into the ditch by a 2-yard crawler crane and returned to the pile by a smaller machine standing back in the spoil pile. The contractor is the Torson Construction Co., Long Beach, Calif., which has six Link-Belt cranes and draglines on the job.

Estimating Flood Crest Run-Off

(*Continued from page 20*)

The deduction factor "D," for small areas, is not of much practical importance, but in order to show the effect of different classes of subsoils, it seems wise to offer the showing.

For black loam or clay superimposed on clay subsoils $D = \frac{0.045}{h^{0.35} A^{0.13}}$ (14)

For silt loam superimposed on sandy subsoils $D = \frac{0.18}{h^{0.35} A^{0.13}}$ (15)

From these statements (14) and (15), it appears that the degree of perviousness found in the subsoil is not a material flood factor on small areas, while it becomes more and more important for larger areas and longer times of concentration. Since "C" approximates 100% when the area reduces to the size of a 12-inch recording gage and since this is the size of the gages used in the collection of data, it may be deduced that the "D" factor reduces to zero for impervious areas.

The recording of short-time intensities by automatic gages has been going on in the United States at various major stations for about 50 years. From these records, a rainfall curve may be compiled for a given locality. For the benefit of those interested in the possible ultimate maximum, the writer's theory of accidental elements in multiplication (d) appears to be somewhat justified (e) and this suggests that the limit of rainfall intensity is approximately double the intensity found to occur once in fifty years. A comparison of actual known extremes with the fifty year curve derived from the recording gage records of Minnesota seems to indicate a similar conclusion.

It must be admitted that this view of the flood-crest problem runs into complications, but simple solutions have proven failures and these showings may all be reduced to a series of four charts whereby the estimate of flood-crest discharge becomes the work of a few minutes after the proper field data have been obtained. The Concentration Time Diagram shows a graphic solution of (2)-(8).

Since the foregoing was written, evidence has appeared suggesting that in the Mississippi Delta, below the Ohio mouth, and in bordering regions, storms of still another type constitute a source of flood crests. In the case of areas exceeding 4000 to 5000 acres, this type of storm seems to show longer times of concentration and higher coefficients of run-off than indicated for the ordinary extreme storm.

(d) Trans. A. S. C. E. Vol. 94 (1930) pp. 951-954.
(e) Monthly Weather Review (U. S. D. A.) Vol. 58, 490-493

Cannery Waste Treatment at Greenwood

Work is under way on the construction of waste treatment works at the Stokely Brothers Packing Plant at Greenwood, Indiana. The proposed plant is flexible and has been designed to give partial treatment to the various kinds of wastes produced by the packing of peas, green beans, lima beans, beets, tomatoes, corn, hominy, and pumpkin. This treatment plant will assist in correcting the insanitary condition of Pleasant Run, which has formerly received the untreated wastes from the cannery and the untreated domestic sewage from the town of Greenwood. The necessity for providing treatment of the domestic sewage is now under consideration by town officials.

The Water Wheel

(Continued from page 28)

11. *t.* Analyzing Hydraulic Models for Effects of Distortion. Morrough P. O'Brien, pp. 313-315.

Johnson National Drillers Journal, August-September.

12. Pulling Well Screens Safely by the Sand-Joint Method. pp. 1-3.
13. Discussion of the Subject of Estimating Drawdown. Clayton N. Ward, pp. 5-9.

Journal American Water Works Association, September.

14. Colon-Aerogenes Types of Bacteria as Criteria of Fecal Pollution. Fred O. Tonney and Ralph E. Noble, pp. 1267-1280.
15. Conformity of Public Water Supplies to the United States Treasury Department Standards. R. E. Tarbett, pp. 1281-1287.
16. Numerical Rating of Public Water Supplies. E. Sherman Chase, pp. 1288-1304.
17. Comparison of Results with Standard Lactose, Brilliant Green Bile and Dominick-Lauter Broths. N. J. Howard, pp. 1305-1310.
18. Care of Public Water Supplies. Carl Wilson, pp. 1311-1315.
19. Report of the Committee on Filtering Materials, pp. 1316-1340.
20. Manganese and its Relation to Filters. Perkins Boynton and Lewis V. Carpenter, pp. 1341-1351.
21. Filter Problems and Water Softening. Charles H. Spaulding, pp. 1352-1357.
22. Further Experience with High Rate of Filter Wash. W. C. Lawrence, pp. 1358-1363.
23. Water Softening by Zeolite in Municipalities. S. B. Applebaum, pp. 1364-1393.
24. Experience with Activated Carbon. George R. Spaulding, pp. 1394-1400.
25. Present Status of Aeration. F. E. Hale, pp. 1401-1415.
26. Floc Formation and Mixing Basin Practice. George E. Willcomb, pp. 1416-1441.
27. Sedimentation Basin Research and Design. Arthur B. Morrill, pp. 1442-1463.

Manufacturers Record, September

28. *c.* Construction Features of 30,000,000 Gallon Covered Reservoir at Louisville, pp. 30-31.

Proceedings Am. Soc. of Civil Engineers, September.

29. Forests and Stream Flow. Discussion by C. G. Bates of paper by Hoyt & Troxell, pp. 1288-1293.

Proceedings, American Geophysical Union, Section of Hydrology, 1932 Annual meeting.

30. *t.* The Hydrology of Snow. J. E. Church, p. 277.
31. The Adirondack Snow Survey. E. C. Cullings, pp. 280-282.
32. *t.* Absorption and Transpiration. Charles H. Lee, pp. 288-298.
33. *t.* Underground Water. David G. Thompson, pp. 298-305.
34. *t.* Permeability of Water-Bearing Materials. L. K. Wenzel, pp. 313-317.
35. *t.* Equation for Lines of Flow in Vicinity of Discharging Artesian Well. Charles V. Theis, pp. 317-320.
36. Characteristics of Runoff of Southeastern Alaska. Fred F. Henshaw, pp. 320-322.
37. *t.* Forces Acting on Soil Moisture in Relation to Other Fundamental Functions. N. E. Edlefsen, pp. 328-330.
38. *t.* Disposal of Moisture from the Aerated Portion of Soils. F. J. Veihmeyer, pp. 330-331.
39. *t.* Relation of Hydrographs of Runoff to Size and Character of Drainage Basins. Le Roy K. Sherman, pp. 332-339.
40. *t.* Drainage Basin Characteristics. Robert E. Horton, pp. 350-361.
41. *t.* Fluctuations of Water Levels in Observation Wells in Virginia. R. C. Cady, pp. 370-373.
42. *t.* Fluctations of the Groundwater Table in Pennsylvania. S. W. Lohman, pp. 373-375.
43. *t.* New Formula for Predicting Annual Runoff of Some California Watersheds. A. F. Gorton, p. 388.
44. *t.* Rainfall and Runoff Characteristics of the Delaware River Basin. Clarence S. Jarvis, pp. 388-390.
45. *t.* Checks on the Model Law for Hydraulic Structures. Morrough P. O'Brien, pp. 390-394.

Proceedings, Texas Water Works Short School 1932 Meeting.

46. Program for Bettering Water Supplies in Texas. J. C. Anderson, pp. 17-19.
47. Relation of City Health Department to Water Supplies. A. H. Flickwir and W. N. Dashiell, pp. 19-23.

48. Modern Methods of Aeration. Herman B. Anderson, pp. 23-27.
49. Iron Removal without Filtration at Kansas State Penitentiary. E. T. Archer, pp. 27-30.
50. Facts Affecting Conversion of Delivery and Service Mains. R. H. Fash, pp. 31-32.
51. *t.* Ammonia-Chlorine Treatment of Water and its Recent Application at Wichita Falls, Tex. A. H. Douglas, pp. 32-36.
52. Ammonia-Chlorine Treatment of Water. Julian Montgomery, pp. 37-40.
53. *t.* Relative Usefulness of Well Water Pumps—Centrifugal Turbine, Air Lift and Piston Type. J. G. Montgomery, pp. 40-44.
54. *t.* Methods of Determining Efficiencies of Centrifugal Pumping Units. M. L. Whitney, pp. 44-48.
55. The Use of Activated Carbon in Water Purification. E. L. Filby, pp. 48-55.
56. Taste and Odor Control in Drinking Water Supplies. L. C. Billings, pp. 55-64.
57. *t.* Water Works Valuation in Rate Making. Jas. D. Fowler, pp. 64-70.
58. Some Results of Cooperative Federal and State Survey of Underground Waters of Texas. Walter N. White, pp. 70-76.
59. *t.* Determining Factors in Selection of Industrial Water Purification Equipment. O. A. Decelle, pp. 76-80.
60. Pollution Hazards of Ground Water Supplies. Fred. H. Puckhaber, pp. 80-89.
61. Criteria for Determining the Sanitary Quality of a Drinking Water Supply. Chester Cohen, pp. 89-94.
62. *t.* Boiler Feed Water Problems. Helman Rosenthal, pp. 94-102.
63. What Constitutes a Satisfactory Water for Ice Manufacture? J. C. Tucker, pp. 102-104.
64. Service Installations. Art Woods, pp. 104-109.
65. *t.* Installation and Repair of Water Mains. W. H. Waring, pp. 109-114.
66. Pipe Jointing Compounds and Materials. D. W. Robinson, pp. 114-119.
67. *t.* Equipment necessary for the Efficient Operation of a Small Water Works Service and Repair Shop. T. L. Lain, pp. 119.
68. Mineral Water Production and Purity of Bottled water. W. J. Miles, pp. 120-126.

The Surveyor and Municipal and County Engineer, Aug. 19.

69. *n.* Corrosion and Treatment of Cast-Iron Water Mains, p. 163.

Water Works and Sewerage, August

70. *t.* Present Practice of Aeration. John R. Baylis, pp. 275-281.
71. *t.* Rapid Detection of Rates of Corrosion with Simplified Apparatus. Cloyd M. Chapman, pp. 282-284.
72. Water Supply Improvements at Farmington, Conn. George H. Buck, pp. 292-294.

September

73. *t.* Ferric Iron Coagulation of Soft Water. Earl C. Craig and Elwood H. Bean, pp. 301-304.
74. *t.* Specifications for Powdered Activated Carbon. John R. Baylis, pp. 311-314.
75. Treatment of Circulating Water for Cooling Purposes. Charles P. Hoover, pp. 317-318.
76. Routine Waste Surveys. E. T. Crauch, pp. 319-320.
77. *n.* Informing Water Works Visitors and Consumers. S. D. Poarch, p. 320.

Water Works Engineering, August 24.

78. Improved Customer Relations. Eben F. Putnam, pp. 1002-1005.
79. Continuous Leakage Survey. A. R. O'Reilly, pp. 1006-1007.
80. Tests Made to Prolong Life of Paint on New Water Tanks. D. W. Johnson, pp. 1010-1012.
81. The Control of Water Works through Adoption of Meterage. Edward E. Ruehl, pp. 1012-1013.
82. Emergency Chlorination Operations. Symposium, pp. 1014-1017.

September 7

83. Tastes and Odors Due to Algae. Samuel E. Killam, pp. 1052-1055.
84. Water Works Construction Loans. R. F. C. Instructions, pp. 1056-1060.
85. Common Sense Principles Applied to Work of the Meter Reader. L. D. Shively, pp. 1061-1062.
86. Licensing Water Plant Operators. Symposium, pp. 1066-1068.
87. Results of Experiments on High Rate of Filter Wash. W. C. Lawrence, p. 1071.
88. How Often Should Water Meters Be Tested for Registration? H. F. Blomquist, pp. 1073-1074.
89. Maintaining the Water Works upon a Sound Financial Basis. Ben S. Morrow, pp. 1074-1077.

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90. Colombo's Water System. Walter Buchler, pp. 1126-1127.
91. Financial and Physical Improvement in a Small Town Water Supply. Frank S. Cole, pp. 1128-1130.
92. Well Screens Freed of Incrustation by Acid Treatment. H. O. Williams, pp. 1132-1134.
93. Special Water Rate During Summer Months. Symposium, pp. 1153-1155.
94. Experiences of a Small Town in Use of Concrete Reservoir. Samuel G. Wylie, p. 1159.
95. Results Obtained from Ammonia-Chlorine Treatment at Okmulgee. Ernest H. Skinner, p. 1164.
96. Sanitary Control of Wells and Cross Connections in Illinois. Clarence W. Klasser, pp. 1167-1168.
97. Relations between the Water Works Superintendent and His Community. F. P. Stradling, pp. 1176-1179.
98. Removal of Tastes and Odors in Filtered Water at Newport News, E. F. Dugger, pp. 1179-1180.

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99. Method of Estimating Ground-Water Supplies, Based on Discharge by Plants and Evaporation from Soil. Walter N. White, 105 pp. Geological Survey Water Supply Paper No. 659-A.

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Highway Equipment and Materials

Road Material Testing Equipment

The American Instrument Company, Washington, D. C., manufactures not only the standard equipment for testing road materials, but several other items of especial interest to highway and testing engineers including the following:

A "humidity and temperature-controlled cabinet" is used for aging cement briquets according to A. S. T. M. C77-30. The temperature inside the cabinet is held at 70°F., regardless of whether the room is above or below that temperature; and a constant relative humidity of over 90% is maintained. Provision is made for storing briquets either in the moist air or in water.

The "Delimeter" is an instrument for limiting the pressure applied during the molding of briquets to within the limits specified in A. S. T. M. C 9-26. Inasmuch as the molding pressure has been found to have a measurable influence on the tensile strength of the samples, use of this instrument provides valuable assurance of comparability of results obtained for different mortars, or by different operators.

The "Soil Pressure Cell" developed in the laboratories of the U. S. Bureau of Public Roads is furnishing engineers valuable information on the earth pressure developed in hydraulic fills, foundations, footings, concrete forms, etc.

Bulletins describing this equipment will be sent upon request to the manufacturer.

FWD Announces New Heavy Duty Trucks

The Four Wheel Drive Auto Company of Clintonville, Wisconsin, has announced a complete new line of heavy-duty trucks for 1933. The models range in size from the 2 to 2½-ton four-wheel drive to the 15-ton six-wheel drive, and incorporate many new improvements. Special mention is made of two primary models, featured for use in major FWD markets; they are the H6 of 2-2½ tons capacity, for road maintenance; and the CU6 of 3½-4 tons capacity, for road building and snow removal. Each of these trucks incorporates the basic four-wheel drive principle of propulsion and such refinements as are applicable to their field of use.

One of the New FWD Trucks

A New Trailer on Pneumatics

A new trailer has been announced by the C. R. Jahn Company, 1140 First National Bank Building, Chicago. This is mounted on pneumatic tires and is the only one of its type that can be had in capacities so mounted up to 35 tons. It has all the advantages of other LaCrosse Tu-Way trailers. It is fully reversible and travels either direction, eliminating turning around at the end of the haul and often speeding up and simplifying loading. Steering is controlled from either end on all wheels so that sharp corners are easily negotiated without swinging out into the traffic. Double end, all wheel brakes assure safety.

A Pneumatic-Tired Trailer

Pumping Concrete

For the first time in America concrete was pumped to the forms in quantity when the Pumpcrete, made by the Chain Belt Company, Milwaukee, went into action on the Thirty-fifth Street Viaduct in Milwaukee. Pumpcrete is a concrete pump for delivering concrete to the forms by direct pumping action, and apparently is the successful solution to a method of placement by direct pumping that has long interested concrete engineers.

Pumping Concrete

The Milwaukee demonstration lasted twelve hours, during which the Pumpcrete handled 125 yards of mixed concrete to forms, including 1½ hours' idle time waiting for delivery. The pump has a capacity of 15 to 20 yards of concrete per hour, and is portable. It will transport concrete 500 feet horizontally, or up to 72 feet vertically.

In the Milwaukee test, concrete of the standard mix being used on the project was delivered in Moto-Mixers to the hopper of the pump. The concrete, as it was delivered to the forms, was rigidly inspected and was found perfectly satisfactory.

Barber-Greene New Anti-Friction Conveyor Carrier

A new Anti-Friction Conveyor Carrier has just been announced by the Barber-Greene Company, Aurora, Illinois, manufacturers of standardized material handling machines. The roller bearings (Shafer) are self-aligning, and take thrust as well as radial load. Each size of carrier has but one size roller unit, making these units and component parts interchangeable. The Barber-Greene carrier is made to interchange with any standard carriers for making replacements.

The roller is made of 5½" dia. seamless tubing No. 9 gauge thick metal. The ends are made of pressed steel with the outer roller race inserted under pressure.

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380. For low cost removal of tastes and odors from potable waters. Used by more than 300 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps, Self-Priming

416. "Make your present pumps self-priming." Bulletin No. 530 B describing the Hazleton Suction Line Primer which can be applied to old as well as new pumps regardless of make. Issued by Barrett, Haentjens & Co., Hazleton, Pa.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago. Ill. Book 642.

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Treatment

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Snow Removal

Snow Fences

347. "Control Winter Drifts"—A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

359. Gallon Iron Works and Mfg. Co., Gallon, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Continued on page 46

MAIL THIS COUPON FOR COPIES OF INDUSTRIAL LITERATURE

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10-32

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Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n., National Press Building, Washington, D. C.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville. Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

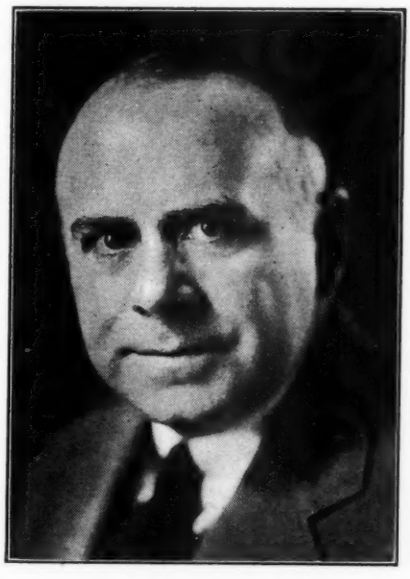
79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Tenth Asphalt Paving Conference

The Tenth Annual Asphalt Paving Conference will be held at the Roosevelt Hotel, New Orleans, from December 5th to 9th with a business and technical program designed to consider current problems of most importance to national, state and county highway officials, engineers, technologists and contractors. The conference will be held under the auspices of The Asphalt Institute of New York and The Association of Asphalt Paving Technologists.

J. E. Pennybacker, Managing Director of The Asphalt Institute and in charge of all arrangements, has announced that the schedule includes an explanation by S. S. Lewis, Pennsylvania Secretary of Highways, of how that state is successfully solving its farm-to-market road problem, and an address by Thomas H. MacDonald, Chief of the United States Bureau of Public Roads.

Because the ever-increasing diversion of gasoline tax funds from road building purposes, amounting to more than $20,000,000 last year, threatens the existence of gasoline taxes as a main sinew of road building, W. R. Boyd, Executive Vice-President of the American Petroleum Institute, will deliver a comprehensive address on that subject.



Thomas H. MacDonald

The Pennsylvania phase of county road building, which has been in the spotlight since Governor Pinchot made this type of practical farm relief an issue in his 1930 election, will be described by Mr. Lewis from the angle of its adaptability to township needs of other states. Already 2,269 miles of the 20,000-mile project have been completed at a cost of only $5,300 a mile.

The main function of the forthcoming conference is to serve as a clearing-house of new and useful ideas pertaining to road building. More particularly, most of the discussions will center about the nationally vital question of how best to make smaller road budgets meet ever-expanding road building progress.

The conference subjects and speakers have been bracketed under the various groups of persons most likely to be concerned with each specific address and relevant subject of discussion.

Highway Officials:

Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads. (Subject of address not yet announced.)

"How Pennsylvania is Solving the Farm-to-Market Road Problem."—S. S. Lewis, Secretary of Highways, Pennsylvania.

"The Menace of Tax Diversion"—W. R. Boyd, Executive Vice-President, American Petroleum Institute.

Committee Reports.

Highway Engineers:

"Factors Determining the Choice of Road Mix or Plant Mix, Respectively, for Low Cost Graded Aggregate Surfaces."—Representative of State Highway Department of California.

"Road Mix with Macadam Aggregate."—O. W. Merrell, Director of Highways, Ohio.

"Asphalt as a Resurfacing Medium for Pavements."—Elmer Lawton, Deputy Highway Commissioner, New York.

"Hot Mix and Its Place in the Highway Program."—Larry B. West, President, West Construction Company.

"Oil Mat Surfaces."—W. V. Buck, State Highway Engineer, Kansas.

"Cutback Asphalts—Their Characteristics and Use."—Prevost Hubbard, Chemical Engineer, The Asphalt Institute.

"Asphalt Priming Material — Character and Use."—W. H. Foushee, Senior Bituminous Engineer, North Carolina Highway Department.

Emulsified Asphalt for Highway Construction and Maintenance."—J. G. Campazzie, President, Headley Emulsified Products Company, Philadelphia.

"Emulsified Asphalt in Penetration Type Construction."—V. L. Ostrander, Shell Eastern Petroleum Products, Inc., Albany.

"Emulsified Asphalt for Mixing Type Construction."—C. L. McKesson, Director of Engineering & Research, American Bitumuls Company, San Francisco.

"Emulsified Asphalts for Surface Treatments and Maintenance Methods."—J. S. Miller, Manager, Technical Department, the Barber Asphalt Company, Maurer, N. J.

"Developments in Asphaltic Types in Canada."—Representative, Ontario Department of Highways.

"Specifications for Liquid Asphalt Products."—E. F. Kelley, Chief, Division of Tests, U. S. Bureau of Public Roads.

Paving Technologists:

Annual meeting and Technical Session of the Association of Asphalt Paving Technologists on Dec. 7 and 8.

"Relative Viscosities of Liquid Asphaltic Materials at Various Test Temperatures."—J. T. Pauls, Highway Engineer, U. S. Bureau of Public Roads.

"Investigation of Mineral Fillers for Asphalt Mixtures."—J. S. Miller, Jr., Director, Technical Bureau, the Barber Asphalt Company.

"Developments in Road Equipment and Its Use."—B. E. Gray, Highway Engineer, the Asphalt Institute.

Discussion by technical representatives of manufacturers for the purpose of bringing out in detail all advances in equipment and its use in recent years.

Motion pictures.

The first session will start Tuesday, December 6th, with an opening address

S. S. Lewis

by Governor O. K. Allen of Louisiana, followed by addresses from T. S. Walmsley, Mayor of New Orleans, William H. Kershaw, President of The Asphalt Institute, and Henry L. Howe, President of The Association of Asphalt Paving Technologists. Mr. Kershaw will preside as chairman of the first day's meeting.

Local arrangements are in charge of Bryson Vallas, General Chairman. Entertainment features, starting on Monday, December 5th, with an informal reception and dance, will include a "Night on the Mississippi" Tuesday evening, comprising a boat ride on the river with dancing, cabaret and an oyster bar operating during the entertainment; a visit to the races on Wednesday with free admission tickets being provided, followed by an inspection of the local airport, highway and Mississippi River revetment work. On Thursday at 2 P. M. the ladies will have a sightseeing tour through the Old French Quarter (Vieux Carre), along with a shopping tour and a visit to Hibernia Tower. There will be a supper dance on Thursday evening; and later a bridge party for the ladies.

One evening will be left entirely open so as to provide time for visitors to arrange private dinner or supper parties at the various noted local cafes. Friday, December 9th, will be devoted to a golf tournament starting at 9 A.M.

All railroads in the United States and Canada have granted a reduced rate of one and one-half fare for the round trip, including the option of returning home by a different route.

USE THE COUPON ON THE BOTTOM OF PAGE 45

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

108. "Keeping Trucks in Condition for Keeping the Highways Open," a comprehensive, 32-page, illustrated booklet containing much valuable information on the proper care of snow removal equipment to prolong its life. Issued by Dept. B, the

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., on Tuesday, October 25, 1932, for the reconstruction of highways in the following counties:

	Deposit Required
BROOME	
TIOGA (Cons. & Recons.) (Prel. Grad. & Structures Prel. Gravel Surfacing: 5.23 miles)	$10,000.00
COLUMBIA (Bit. Mac. M. M. Type 3: 0.34 miles)	1,400.00
CORTLAND (Concrete: 0.90 miles)	3,000.00
ONEIDA (53.5' I-Beam; 70' Girder Bit. Mac. M.M.O. Approach: 0.24 miles)	1,700.00
ONONDAGA (D. L. & W. Elimination) (Plain Concrete: 1.31 miles)	3,500.00
OTSEGO (D. & H. Elimination) (Concrete & Bottom Course, Bit. Mac. Pen. Method: 2.055 miles)	13,000.00
TOMPKINS (32' I-Beam, Bit. Mac. Opt. Appro: 0.02 miles)	400.00
ULSTER (Concrete: 3.11 miles)	14,000.00

Proposals will also be received for the construction of Office Buildings at Watertown, Jefferson County, and at Hornell, Steuben County.

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose districts the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Streets, New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

The contracts mentioned above as being in the Counties of Cortland and Ulster are Employment Relief Projects. The minimum rate for unskilled labor on these contracts shall be from forty cents to fifty cents per hour, as specified in each contract, and the minimum rate for skilled labor shall be fifty cents to sixty cents per hour, as specified in each contract.

Veterans of the U. S. Military Service with dependents, where qualified to do the work, shall be given preference in employment. No person, except those in supervisory, executive or administrative positions, shall be employed for more than thirty hours in any week. Details of these regulations with respect to preference in employment, use of hand labor, hours of employment, etc., will be found in the itemized proposal.

A. W. BRANDT,
Commissioner of Highways.

Highway and Building Congress —and Road Show

The well-known Road Show will, this year, be combined with other national public works organizations into the 1933 Highway and Building Congress, which will be held in Detroit the week of January 16. In previous years each of the associations taking part has held its separate convention. Therefore, the bringing together of the numerous groups for joint consideration of mutual problems at one time and place is an innovation.

On the first three days, separate meetings of the individual associations taking part in the Congress will be held. Thursday, the fourth day, will be devoted to highways, and Friday, the final day, to building and general construction. By such an arrangement of programs each participating association will retain its individual identity, conducting its usual convention program in its separate meetings on the first three days. All will merge individual aims in staging the programs on Thursday and Friday.

Two exhibits of equipment and materials will feature the Congress. One embracing highway and building construction and maintenance equipment and materials will be staged in the Municipal Airport Building, and the other, presenting equipment and materials of special interest to material producing groups, will occupy space in the Book-Cadillac Hotel.

Already the following associations have joined in the plans for the Congress: Construction League of the United States; American Road Builders' Association; Associated General Contractors of America; Truck Association Executives of America; The Asphalt Institute; Associated Equipment Distributors; National Crushed Stone Association; National Paving Brick Association; National Ready Mixed Concrete Association; National Sand and Gravel Association; Portland Cement Association; American Society of Municipal Engineers; Steel Founders' Society of America, Incorporated; American Institute of Steel Construction.

National Paving Brick Association

The 27th annual meeting of the National Paving Brick Association will be held at the Book-Cadillac Hotel in Detroit January 17-18, 1933, in connection with the Highway and Building Congress. The sessions on January 18th will be open to the general public, and those interested in street and highway development are invited to attend.

The program, now under preparation, will be presented by prominent engineers, contractors and paving authorities. It will include descriptions of recently constructed brick highways, streets and boulevards. There will be discussions of the application of highway research to modern brick pavement design, including filler and cushion construction. How unemployment has been relieved by turning over and relaying old brick pavements, after a generation of service, will be described. Brick for resurfacing worn pavements and bases, an important and increasing utilization, will be a prominent feature of the program.

O. W. Renkert, Metropolitan Paving Brick Company, is President, and George F. Schlesinger, formerly State Highway Director of Ohio, is Chief Engineer and Secretary of the National Paving Brick Association.

Headquarters of the Conference will be at the Deshler-Wallick Hotel, where the meetings will be held. The first session will be Thursday afternoon, the 13th, to enable those attending the Water Purification Conference, which will be held at Warren on October 11 and 12, to reach Columbus in time for participation in the Sewage Conference.

Among the papers to be presented is one by W. C. Purdy, special expert of the U. S. Public Health Service, on Minute Forms of Stream Life and another by Dr. R. R. Sayers, Chief Surgeon, U. S. Bureau of Mines, on Gas Hazards incident to sewage plant operation.

One entire session is to be devoted to a round table discussion of pertinent topics relating to plant operation. Opportunity is to be afforded also for inspection of the new sewerage improvements at Columbus.

Other Technical Meetings

The 1933 meeting of the American Society for Testing Materials will be held at the Stevens Hotel, Chicago, Ill., June 26 to 30, during the Century of Progress Exposition.

The Tenth Annual Meeting of the Michigan Conference on Water Purification, which includes in its membership waterworks chemists, analysts and operators, will be held at the Media Hotel, Mt. Clemens, Mich., October 5, 6 and 7. E. D. Rich, Lansing, Mich., is director of the Bureau of Engineering.

The sixth annual meeting of the Rocky Mountain Section, American Water Works Association, will be held at the Cosmopolitan Hotel, Denver, Colo., October 24-26. Dana Kepner, 226 Continental Oil Bldg., Denver, is secretary of the section.

The Missouri Water and Sewerage Conference will hold its Eighth Annual Meeting in Sedalia, Missouri, on October 13 and 14, 1932, at the Bothwell Hotel.

The Sixth Annual Ohio Conference on Sewage Treatment will be held October 13 and 14, 1932, at Columbus.

Personal News

Charles H. Hurd, Consulting Engineer, has moved his office to 1041 Architects and Builders Bldg., 333 North Pennsylvania Street, Indianapolis, Ind.

Harry L. Moody has resigned as General Sales Manager of the Edge Moor Iron Company to become District Sales Manager of The Hydrauger Corporation, 233 Broadway, New York City. Mr. Moody was formerly connected with the Westinghouse Machine Company and Westinghouse Electrical Manufacturing Company in their Boston office. In 1923, he left to go with the United Gas & Improvement Company, in charge of their new business activities. Later, he became connected with the Edge Moor Iron Company as General Sales Manager.

The Koppers Construction Co., Pittsburgh, Pa., recently acquired control of the Hiler Engineering & Construction Co. The Hiler company is engaged exclusively in the design and construction of Heenan system refuse incinerator plants of the brick-set, top-feed, high-temperature, mutual assistance, multiple-cell type, with provision for the use of forced draft and preheated air.

Above are shown five Case Model "CI" Industrial tractors mounted in Spears-Wells maintainers with scarifier attachments, which were purchased recently by the state of California.

Index to Advertisements

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 45 and order by number.